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FOUNDRY TRADE JOURNAL

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PLANNED *for specific requirement by* August's LIMITED

MODERN FOUNDRY LAYOUT

Photograph published by courtesy of The Hill Top Foundry Co., Limited, Wednesbury.

● Photograph shows: A General View of a Section of a large Iron-foundry. One of the main Distributing Belt Conveyors can be seen, for feeding the Mixed Sand to the Moulders Supply Hoppers.

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FOUNDRY
TRADE JOURNAL

Vol. 104 APRIL 3, 1958 No. 2164

New Steel Prices

Last week, the Iron and Steel Board announced that the maximum prices for a wide range of steel products were to be decreased by 1 to 3 per cent. This was, in the main, made possible by the reduction in freight charges for the carrying of iron ore to this country from overseas. The result of this gesture is that consumers will benefit by something of the order of £10,000,000 a year. We attach much importance to the statement made to the Press, that these prices were to be stabilized for a considerable period; this should stop buyers reducing their stocks in the hope of a further reduction. In the use of steel in manufacturing processes, there is much waste, as the scrap piles visibly demonstrate, so that the reduction in the end products assumes a more serious percentage.

In common with all ironfounders, we were candidly disappointed to see that pig-iron was excluded. It may be the economic conditions applicable to steelmaking do not have the same repercussions as in pig-iron manufacture, where it is not an inter-departmental matter, but its subsequent sale to outside customers. The pig-iron makers are finding it difficult to sell their product to the ironfounders. Glib advice is that the art of selling starts when the buyer says no. The science of selling, however, involves the provision of goods at a price which will attract business, and we regret that the authorities did not think along these lines.

The reduction in the price of steel will have some small effect on the foundry industry. The equipment makers use steel in the construction of foundry plant, but this is small compared with the general economic position. British steel is probaby the cheapest in the world, and for the first time in 20 years, prices have been lowered. Moreover, there is now no need to import expensive scrap from America, which uses up quantities of dollars, or pig-iron from the European countries. All these factors are of real importance and if there be any revival in the export business, British prices, which are not controlled in this connection, should be of advantage in obtaining overseas contracts. Whenever plant is exported, the foundry industry benefits indirectly. Thus, we welcome the gesture made by this steel industry.

Correspondence

ORNITHOLOGY AND THE FOUNDER'S ART

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—The short note in your March 13 issue linking ornithology with the foundry was obviously not intended to be comprehensive. The castings referred to by your contributor are mostly iron and it may be appropriate to supplement these by an example or two in a metal which would offer less gravitational resistance to flight (and one which is in fact carried by thousands of ringed birds). The photograph which I have enclosed illustrates a fine example of foundry

craftsmanship, and shows one of the cast-aluminium eagles which Napoleon III ordered in 1861 to replace the bronze eagles then surmounting the standards of French regiments. That 1861 is only five years after the emergence of aluminium from the laboratory adds historic interest. By contrast, the most recent "feathered" examples of sand casting skill are the nearly life-size aluminium-alloy cockerels which have been produced for a well-known London brewery.

(The fact that the word formed by our organization's initial letters "ALAR," means "pertaining to wings" is purely coincidental and does not imply a specialized interest in ornithology!) Yours etc.

F. H. SMITH.
Development Officer.

Alar Limited, 3, Albemarle Street, London, W.1.
March 17, 1958.

IVE Northern Section Notes

The Northern section of the Institute of Vitreous Enamellers has arranged a social evening at the Old Nag's Head, Jackson's Row, Deansgate, Manchester, for April 17. This will include a film show on electrostatic spraying, dinner and entertainment, the ticket cost being 15s. 6d. Applications to attend should be addressed to the local secretary, Mr. O. Dreyer, 15, Albemarle Avenue, Withington, Manchester, 20, without delay.

XXV International Foundry Congress

At the twenty-fifth International Foundry Congress, to be held in Belgium from September 29 to October 4, 1958, the following papers emanating from the various overseas technical associations have been accepted: "Technical Factors affecting the Growth of Iron-castings Production in Industrialized Countries," by Mr. Lars Villner (Sweden); "French Foundry Training Methods: the Future Outlook," by Mr. D. Waeles (France); "Research Results on Ni/Cu/Mn Non-magnetic Irons," by Professor A. De Sy and Mr. J. Van Eeghem (Belgium); "Gases in Cast Iron," by Dr. B. Marincek and Dr. H. Feichtinger (Switzerland); "Adapting Theory to Practice in making High-strength Light-metal Castings in Sand Moulds," by Professor H. F. Taylor and Dr. M. C. Flemings (USA); "Improvement of the Properties of Cast Light Alloys by Vacuum Treatment," by Mr. Z. Eminger and Mr. M. Kletecka (Czechoslovakia); "Temperature Behaviour of Al/Mg Alloys," by Dr. L. J. van Ewijk (Netherlands); "Flow of Aluminium in Sand Moulds," by Mr. G. Ohira (Japan); "The Graphite Structure in Iron/Carbon Alloys," by Dr. A. Wittmoser (West Germany); "Exothermic Feeding of Steel Castings," by Mr. D. H. Snelson (Great Britain); "Evolution of a Water-cooling System for a Cupola," by Mr. C. Longaretti and Mr. C. Pensotti (Italy); "New Aluminium Casting Alloy of the Al/Zn/Si/Mg Type," by Dr. W. Thury (Austria), and "Effect of a Stream of Molten Metal on the Surface of a Sand Mould," by Professor J. Szreniawski (Poland).

(The French have provisionally announced that about 225 of their countrymen will attend and the Germans have mentioned that at least 500 of their country's foundrymen will probably travel to Belgium for the Congress.)

National Society of Master Patternmakers

Tentative arrangements are being made by the National Society of Master Patternmakers for a tour of patternshops in Western Germany from June 11 to 17. Provisionally the programme includes visits to works in Stuttgart, Cologne, Essen, Düsseldorf, etc. Air travel would occupy Wednesday morning, with a works visit in the afternoon, Thursday, Friday and Monday are allocated for more visits to see plant, while on Saturday, there is to be a visit to a technical institute. Sunday and Tuesday morning before departure are to be free for sightseeing, etc. Further details will be circulated as soon as possible, but in the meantime members wishing to participate should apply immediately to the secretaries of the Society at 12, Cherry Street, Birmingham, 2.

Iron and Steel Institute Awards

The Council of the Iron and Steel Institute has recently announced the following awards:—*Bessemer Gold Medal for 1958*: Mr. W. F. Cartwright (Steel Company of Wales, Limited); *Sir Robert Hadfield Medal for 1958*: Mr. W. C. F. Hessenberg (British Iron and Steel Research Association), and the *Ablett Prizes for 1957*: £50 each to Mr. C. E. H. Morris and Mr. R. N. Dale (Steel Company of Wales, Limited) for their paper "Planning the Conversion of a High-lift Slabbing Mill to a Universal Mill."

Fifty-fifth IBF Annual Conference

Technical & Social Proceedings at Buxton, May 13-16

The fifty-fifth annual conference of the Institute of British Foundrymen is to be held at Buxton from May 13 to 16 inclusive. This year, the East Midlands branch of the Institute are organizing the event, and Mr. A. E. Peace, a past-president of that branch, will be installed in the office of president of the Institute during the conference. To enable the programme to include two sets of works visits, so that members attending only a part of the conference will be able to participate in one of them, the duration of the conference has been extended by one day. Also, the date has been brought forward by several weeks to secure the full facilities of the Pavilion Gardens, which would not be available later in the year. Buxton provides an ideal setting for a conference, and its central position offers ready access to the foundry centres which will be visited. Its interesting shops and its geographical situation as the gateway to the Peak District National Park make it also an attractive centre for the ladies.

Conference Office:—The conference office will be established on Tuesday, May 13, at the Pavilion Gardens, Buxton. Communications prior to this date should be addressed to the head office of the Institute, St. John Street Chambers, Deansgate, Manchester, 3.

Programme

Tuesday, May 13

11.15 a.m.: Coaches leave the Pavilion Gardens, Buxton, for the Midland Hotel, Derby (members and ladies).

1 p.m.: Buffet luncheon at the Midland Hotel, Derby.

2 p.m.: Members will take part in one only of the following works visits:—

Ley's Malleable Castings Company, Limited; Qualcast, Limited; Rolls-Royce, Limited; Parker Foundry (1929), Limited; International Combustion, Limited; or Aitken & Company, Limited. Return to Buxton about 6.30 p.m. (For full details of these foundries, see page 385.)

8.30 p.m. to midnight: Reception by the Mayor of Buxton and the Mayoress at the Pavilion Gardens, followed by dancing and refreshments. (Members and ladies.)

Wednesday, May 14

9.15 a.m.: Annual general meeting at the Playhouse, Pavilion Gardens. (Members only). Presentation of awards.

10.45 a.m.: Adjourn for coffee. (Members, invitation.)

11 a.m.: Presidential address by Mr. A. E. Peace.

11.30 a.m.: Edward Williams Lecture entitled "Metallurgy and Aeronautical Progress," by Professor A. J. Murphy, M.SC., F.I.M., F.R.AE.S.

12.30 p.m.: Conference adjourns.

2.30 p.m.: Conference recommences with technical sessions at the Pavilion Gardens.

5 p.m.: Conference adjourns.

7 p.m.: Reception at the Pavilion Gardens by the president and Mrs. Pearce. (Evening dress.)

7.30 p.m. to 1 a.m.: Annual banquet in the Pavilion Gardens, followed by dancing. (Members, ladies and guests; evening dress.)

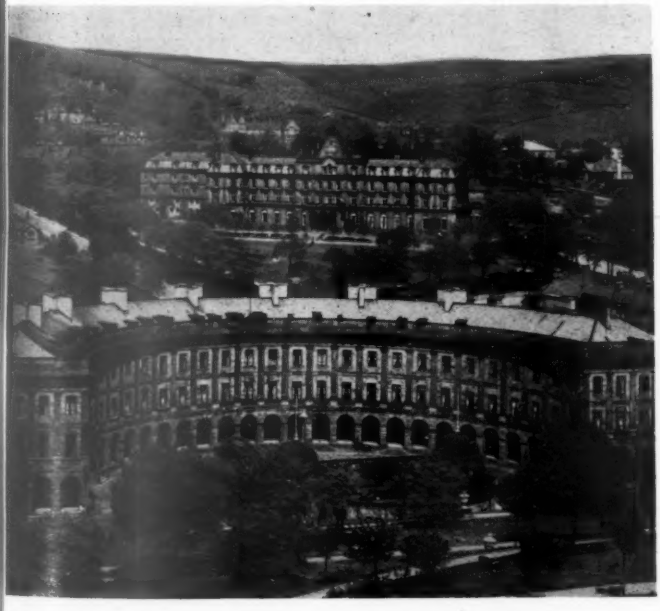

FIG. 1.—*The Crescent and Gardens, Buxton. St. Ann's Hotel can be seen on the left and the Crescent Hotel on the right, with the Palace Hotel in the background.*

Thursday, May 15

Technical Sessions in the Pavilion Gardens: morning, 9.30 a.m. to 12.30 p.m.—afternoon, 2.30 to 5 p.m.

8.30 p.m. to midnight: A performance of Son et Lumière (a pageant of light and sound—the story of Buxton) followed

by an informal evening at the Pavilion Gardens. Orchestral music, dancing, cabaret and light refreshments. (Members and ladies; by kind invitation of the East Midlands branch; lounge suits and cocktail dresses.)

Friday, May 16

Members will take part in one only of the following visits or groups of visits. Depart by coach from the Pavilion Gardens, Buxton.

8.30 a.m.: (1) Morning: (*a*) Stanton Ironworks Company, Limited, Holwell Foundry, Melton Mowbray. Afternoon: (*b*) S. Russell & Sons, Limited, Bath Lane, Leicester. Return to Buxton about 7 p.m.; or

8.55 a.m.: (2) Morning: (*a*) Jackson Bros. (Milton), Limited, Stoke-on-Trent. Afternoon: (*b*) Bamfords, Limited, Leighton Ironworks, Uttoxeter. Return to Buxton about 6 p.m.; or

9 a.m.: (3) All-day visit to the Stanton Ironworks Company, Limited. Return to Buxton about 6 p.m.; or

9.5 a.m.: (4) Morning (*a*) British Railways Foundries, Derby. Afternoon: (*b*) Ley's Malleable Casting Company, Limited, Colombo Street, Derby. Return to Buxton about 6 p.m.; or

9.10 a.m.: (5) Morning: (*a*) International Combustion, Limited, Derby. Afternoon: (*b*) Parker Foundry (1929), Limited, Mansfield Road, Derby. Arrive Buxton on return about 6 p.m.; or

9.15 a.m.: (6) Morning: (*a*) Butterley Company, Limited, Ripley. Afternoon: (*b*) Sheepbridge Engineering, Limited, Sutton-in-Ashfield Works, near Nottingham. Return Buxton about 6 p.m.

8 p.m. to 1 a.m.: Dinner/dance at the Pavilion Gardens. (Members and ladies; evening dress optional.)

Ladies' Programme

Tuesday, May 13

11.15 a.m. to 1 p.m.: Programme as for members.

2.30 p.m.: Ladies leave by coach for one only of the following visits:—

(1) Royal Crown Derby Porcelain Company, Limited. (2) "Leisure" Kitchen Equipment Company, Limited. Tea at the New Inns Hotel, Near Ashbourne, returning to Buxton at about 6.30 p.m.

8.30 p.m. to midnight: Reception by the Mayor and Mayoress of Buxton at the Pavilion Gardens (evening or cocktail dress).

Wednesday, May 14

11 a.m.: Informal reception by Mrs. A. E. Peace and Mrs. J. Blakiston, in the lounge and ballroom at the Palace Hotel, Buxton.

3 p.m.: Beauty culture demonstration by J. & E. Atkinson, Limited, in the ballroom at the Palace Hotel, followed by buffet tea.

7 p.m. to 1 a.m.: Programme as for members.

Thursday, May 15

10.30 to 11.30 a.m.: Coffee and conversazione in the lounge and ballroom at the Palace Hotel.

2.15 p.m.: Ladies leave by coach from the Pavilion Gardens for one only of the following visits:—

(1) Visit to Kedleston Hall, historic home of the Curzon family; returning to Buxton about 6.30 p.m., or

(2) Visit to Hardwick Hall, historic home of the Earls and Dukes of Devonshire; arriving back at Buxton about 6.30 p.m., or

(3) Visit to Haddon Hall; arriving Buxton about 5.45 p.m.

Evening programme as for members.

Friday May 16

Ladies leave by coach from the Pavilion Gardens for one only of the following groups of visits:—

FIG. 2.—*Spring Gardens and shopping centre, Buxton. (Photograph by courtesy of Hillhead Hughes, Limited.)*

10.45 a.m.: (1) (*a*) In the morning, a tour of Dovedale and (*b*) in the afternoon, a visit to the Royal Crown Derby Porcelain Company, Limited; returning to Buxton at about 6.15 p.m., or

11 a.m.: (2) (*a*) Tour of Dovedale in the morning and

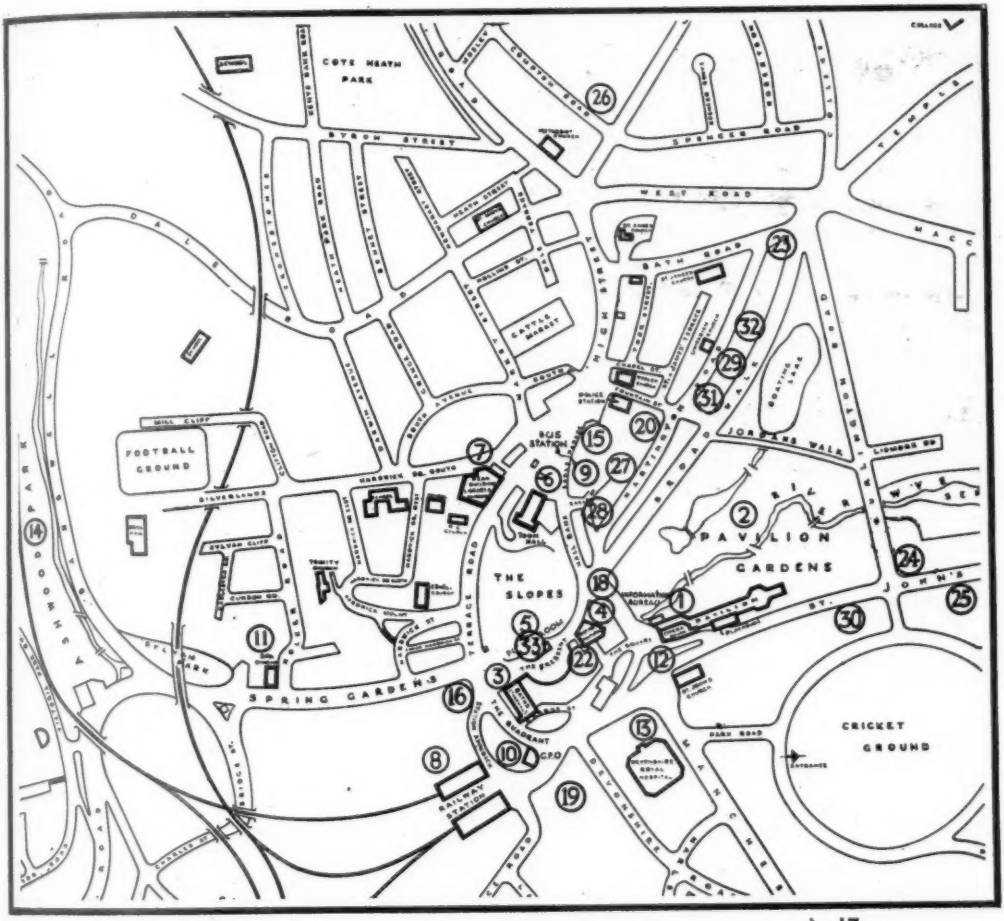

FIG. 3.—*Part of a street plan of Buxton showing principal public buildings (station, post-office, parks, etc.), together with the hotels listed in the IBF Conference circular.*

KEY: (1) Town Information Bureau; (2) Pavilion Gardens; (3) Thermal Baths; (4) Natural Baths; (5) Pump Room; (6) Town Hall; (7) Library and Museum; (8) Railway Station; (9) Bus Station; (10) General Post-office; (11) Spa Cinema; (12) Opera House; (13) Devonshire Royal Hospital; (14) Ashwood Park; (15) Eagle Hotel; (16) Grove Hotel; (17) Leewood Hotel; (18) Old Hall Hotel; (19) Palace Hotel; (20) Spa Hotel; (21) Savoy Hotel; (22) St. Ann's Hotel; (23) Argyle Private Hotel; (24) Buckingham Hotel; (25) Egerton Private Hotel; (26) Griff Guest House; (27) Malvern House Hotel; (28) Pavilion Hotel; (29) Roseleigh Private Hotel; (30) Portland Hotel; (31) Sandringham Hotel; (32) Westminster Private Hotel; (33) Conference Information Office.

(*b*) afternoon visit to British Celanese, Limited. Spondon, Derby; arriving back in Buxton about 6 p.m., or

11.15 a.m.: (3) (*a*) Tour of the Peak District during the morning and (*b*) visit in the afternoon to Remploy, Limited, Chesterfield. Return to Buxton about 5.45 p.m., or

12 noon: (4) (*a*) Tour of South Cheshire and North Staffs, and (*b*) a visit to Josiah Wedgwood & Sons, Limited, Barlaston, Stoke-on-Trent, in the afternoon. Returning to Buxton at about 6 p.m.

8 p.m.: Dinner/dance as announced in members' programme.

Provision of luncheons and teas for members participating in the works visits are kindly being made by the various companies visited.

Applications for hotel accommodation should be made as soon as possible direct to the hotel and not to the Institute, and in all cases the name of the Institute should be mentioned. The last date for receiving conference reply forms (at the Manchester office of the Institute) is April 12.

Technical Sessions

Wednesday, May 14

2.30 p.m. to 5.0 p.m. Two simultaneous sessions.

FIG. 4.—*Turner's Memorial at Buxton; on the left of the picture is the Grove Hotel.*

Session A. (The Playhouse Pavilion Gardens.)

Paper No. 1, "Purification of Pig-iron by Oxidation," by R. H. J. Dixon, A.I.M., A.C.T.(Birm.); No. 2, "Some Experiments on the Cause of Peeling in Whiteheart Malleable Cast Iron," by C. T. Moore. (BCIRA paper); No. 3, "Hot-blast Cupola Heat Exchangers," by E. Longden, M.I.MECH.E. (past-president).

Session B. (Restaurant Annexe, Pavilion Gardens.)

Paper No. 4, "Non-ferrous Surface Finish." Report of sub-committee T.S.48 of the Technical Council; No. 5, "pH Modification and its Influence on Surface Finish," by D. H. Houseman, M.A., PH.D. (associate member); No. 6, "Study of the Pouring of Alloy Castings and Various Running and Risering Systems Employed for Sand Moulds," by M. Jeancolas. (Officially sponsored paper from *L'Association Technique de Fonderie.*)

Thursday, May 15

9.30 a.m. to 12.30 p.m. Two simultaneous sessions.

Session C. (The Playhouse, Pavilion Gardens.)

Paper No. 7, "Production of Moulding Sands," by A. R. Abraham, M.A., J.P. (member); No. 8, "Some Practical Experiences in Making Moulds in a Mechanized Foundry," by H. Pinchin (member); No. 9, "Maintenance of Plant and Equipment," by J. I. Blackbourn.

Session D. (Restaurant Annexe, Pavilion Gardens.)

Paper No. 10, "The Intermediate Metal Thermocouple in Metal/Mould Interface Temperature Measurements," by D. V. Atterton, M.A., PH.D. (member) and D. H. Houseman, M.A., PH.D. (associate member); No. 11, "Instrumentation for the Melting of Non-ferrous Metals," by D. W. Brown, B.SC., F.I.M. (member); No. 12, "Use of Stearin Wax for Simulating Shrinkage Defects in Steel Castings," by D. B. James, B.SC., and J. M. Middleton, A.MET., A.I.M (BSCRA paper).

2.30 p.m. to 5.0 p.m. Two simultaneous sessions.

Session E. (The Playhouse, Pavilion Gardens.)

Paper No. 13, "Pressure or Diaphragm Moulding," by T. E. Barlow (member). (Officially sponsored paper from the American Foundrymen's Society); No. 14, "A Modern Foundry for the Manufacture of Small Steel Castings by New Moulding Techniques," by J. H. Osborn, B.A. (HONS.) (CANTAB.) (member), R. F. Horton (member) and T. A. Marsden (associate member).

Session F. (Restaurant Annexe, Pavilion Gardens.)

Paper No. 15, "Non-ferrous Melt-quality Tests." Report of sub-committee T.S.45 of the Technical Council; No. 16, "Influence of Sulphur on the Castability, Tensile Properties and Pressure-tightness of Sand-cast Bronzes and Gunmetals," by H. Reiter, B.SC. (BNFMRA paper); No. 17, "Some Expansion Phenomena Associated with the Freezing of Non-ferrous Alloys," by W. B. Hendry, B.SC., A.M.I.MECH.E. (associate member) and S. N. Wrightson, B.SC., A.I.MECH.E. (member).

Fall in Aluminium Demand and Sales

Operations of Aluminium, Limited, in 1957 were marked by a decline in demand and sales. Net income was $41,422,456 ($55,657,372), or $1.37 ($1.85) per share, states Mr. Nathanael V. Davis, president of the company, in his annual report. Consolidated net income of the Aluminum Company of Canada, Limited. the principal subsidiary, was $26,498,359 ($45,321,082).

The past year was one of transition for the company and for the industry, Mr. Davis states, the preceding 10 years having been, with few exceptions, years of strong demand, full production, and rapid expansion. Last year supply exceeded demand and the company expects a continuation of over-capacity in the industry as a whole until world markets can be expanded to absorb increases in production.

Capital expenditures in 1957 under the long-range expansion programme were $180,000,000. Of this amount $51,000,000 was expended in Quebec, mainly on the Chute-des-Passes hydro project which is scheduled to have capacity of 1,000,000 h.p. in 1959; $51,000,000 for smelter and power facilities at the Kitimat project in British Columbia, and $44,000,000 for bauxite and alumina projects in Jamaica, British Guiana, and French West Africa. Present plans envisage capital expenditures in 1958 of about $125,000,000.

Alcan produced 556,700 (620,300) tons of primary aluminium in 1957, the reduction being caused by labour difficulties and changing market conditions. Sales of aluminium in all forms by consolidated subsidiaries of Aluminium, Limited, were 614,210 (705,058) tons.

Currently, the company's Canadian smelters are operating at about 80 per cent. of rated capacity, producing substantially as much metal as in the year of peak production, the report states. Deliveries so far this year are below this level, but the general trade demand has shown some signs of stabilizing in recent months.

Machine-tool Materials: Coefficients of Flat-surface Friction*

By A. O. Schmidt and E. J. Weiter

With the development of automatic machine tools and new material applications, particularly to sliding components, the need has grown for a more accurate picture of the frictional behaviour of flat-sliding surfaces. Since interrupted motion is involved the frictional resistance to be overcome in sliding has a range of values under conditions of kinetic friction. In what follows the results of tests with a number of slide and slider materials are described. The former included ground cast iron and hand-scraped cast iron, and the sliders were of various metals and plastics.

The goal of the investigation was to establish the coefficients of static friction, as well as the "break-away," and kinetic behaviour of selected material combinations. The actual profiles of machined flat surfaces show that they are composed of large numbers of peaks (asperities) and valleys (Fig. 1). The contact area is also proportional to the load. The asperities in initial contact must deform elastically and plastically until the contact area is sufficient to carry the load. Where direct contact of asperities is made there is a probability of at least partial welding. Coefficients of static friction are generally given for steady-state conditions which implies that these coefficients are independent of time. However, the time the contacting surfaces are at rest, prior to sliding, produces changes at the interface which affect the coefficient of static friction.

The inclined-plane system and the slider constitute the basic apparatus needed to obtain static coefficients. Usually the slide will resemble the bearing surface of a machine-tool way; *e.g.*, scraped cast iron, ground cast iron, hardened and ground steel, or any other type of way material under consideration. The slider itself can be made of a large variety of materials, either metallic or non-metallic. Usually a bearer-surface contact area of one sq. in. is provided, but this also can be changed easily should requirements of test results so indicate.

Materials Tested

The slide materials used included (*a*) hardened and ground steel, (*b*) ground cast iron, and (*c*) hand-scraped cast iron. Slides (*a*) and (*b*) were finished by standard grinding to a roughness of about 20 microin., rms. Slide (*c*) was hand scraped, having about 20 contact points per sq. in., according to generally-accepted methods used in the machine-tool industry. Slider materials included the following plastics and metals:—(*a*) Formica, (*b*) Wayalloy "A" (plastic with wood filler), (*c*) bearing bronze (aluminium-bronze), (*d*) ground cast iron (C 3.0; Si 1.8, Ni 0.9, Mn 0.7 per cent.), (*e*) Panelyte, (*f*) glass-filled Teflon, (*g*) Teflon, (*h*) graphite-filled Teflon. All these, except, of course, (*c*) and (*d*), are plastics of various kinds.

Slider materials (*a*) and (*e*) had been in storage for several years. Each of the materials was finished by grinding to approximate the finish on the slide, that is, about 20 micro-in., rms.

Procedure

The preparation consisted of washing the contact surfaces with carbon tetrachloride. The plastic sliders were washed in a solution of a standard detergent and water. In all lubricated tests an oil, recommended for use on machine-tool slides, was applied to the slide surface with a felt applicator. The coefficients of static friction are shown in

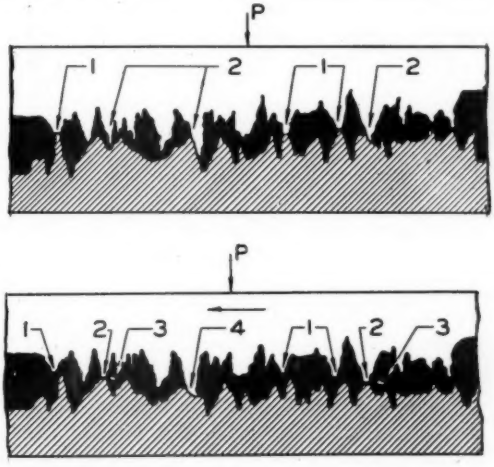

FIG. 1.—*Illustration of static friction between surfaces (top) and change at interface due to initial motion (bottom). Asperity contacts where welding can occur are indicated in the former at* 1 *and the interlocking of asperities and valleys appears at* 2. *Figures in the second drawing show sheared welds* (1), *new welds* (2), *loose wear fragments due to interlocks* (3) *and ploughing* (4).

*This article, which originally appeared in *Mechanical Engineering*, is based on two papers prepared by the same authors and presented at the semi-annual meeting of the American Society of Mechanical Engineers in June 1957. Mr. Schmidt is research engineer, Kearney and Trecker Corporation and research professor, Marquette University, Milwaukee, Wis. Mr. Weiter is assistant professor of mechanical engineering at the same University.

Machine-tool Materials

Tables 1 and 2. Each material pair was run, keeping the time at rest constant. The time at rest was extended for intervals of 0.1, 0.2, 0.3, 0.5, 1.0, 2.5 and 5.0 min., with a minimum of three tests at each interval. Various long-time tests at rest under load for periods of from 1.0 to as much as 144 hours were run whenever possible.

The 10-lb. procedure was repeated, using a 30-lb. and 50-lb. load for each slider material on each of the three slides. In the lubricated tests, lubricant was redistributed with a felt pad between each run to achieve a degree of uniformity throughout the lubricant film. Both the slides and the sliders were also cleaned and relubricated between each load increment. There was a general decrease of friction values when lubrication was applied.

Time and Wear

By maintaining constant the time at rest under load, the effect of initial wear was observed. As wear progressed in a pair of materials, the coefficient of static friction varied according to one of the following patterns: (*a*) it initially decreased and became stable (*b*) initially increased and became stable; or (*c*) remained unchanged. A tabulation of the change in static friction with initial wear is shown in Table 3.

The change of static friction with initial wear can be substantial, up to 100 per cent. in some cases. For example, static friction, for the Formica tested dry on hardened and ground steel with a contact load of 30 lb. per sq. in., was 0.146 in. for the first test, 0.140 in. for the third and fourth tests, and 0.210 in. for test 47, a stable value of 0.212 being obtained in subsequent tests.

Regarding continued change in static friction with progressive wear, cast iron and "bronze" exhibited the most marked increase. This was most pronounced when the tests were run dry. With the harder plastics static friction also increased with continued dry testing. The changes in static friction with respect to the wear produced by successive tests can be attributed to surface changes such as those caused by material transfer and changes in the slide surface can be analysed by comparing the surface profiles. Material transfer was visually observed in inspections of the slide and slider. With certain material combinations, the coefficient of static friction attained a stable value after initial wear, and it was noted that static friction for these materials increased as the interval at rest under load was increased. Extended periods at rest ranging from 1 to 48 hr. indicated increases in static friction but at smaller rates.

Teflon-base materials exhibited the largest rate of change in static friction with time at rest. For lubricated Teflon under a contact load of 30 lb. per sq. in., the rate of increase in static friction for intervals at rest of 0.1 to 1.0 min. was 2.50 by 10^{-2} per min.; for 1.0 to 5.0 min. it was 5.10 by 10^{-3} per min.; and for 5 to 75 min. it was 2.80 by 10^{-4} per min. When the harder plastic-bearing materials were tested under lubrication with a contact load of 30 lb. per sq. in., static friction changed at a rate of 1.88 by 10^{-2} per min. for intervals at rest of 0.1 to 1.0 min., 7.50 by 10^{-4} per min. for 1.0 to 5.0 min.; and 7.00 by 10^{-5} for 16 hr. The plastics exhibited the largest rate of increase in static friction with increased time at rest. Aluminium-bronze and cast iron also showed a tendency for static friction to increase when at rest for prolonged time.

TABLE 1.—*Coefficient of Static Friction—after One Minute at Rest*

Slider.	Dry load.			Base.	Lubricated load.		
	10 lb.	30 lb.	50 lb.		10 lb.	30 lb.	50 lb.
Cast iron	0.330	0.325	0.350	Ground cast iron ..	0.114	0.125	0.142
	0.169	0.200	0.202	Scraped cast iron ..	0.140	0.144	0.130
	No tests	No tests	No tests	Hardened and ground steel	0.114	0.126	0.123
Aluminium-bronze ..	0.296	0.276	0.260	Ground cast iron ..	0.143	0.148	0.150
	0.260	0.260	0.250	Scraped cast iron ..	0.167	0.196	0.211
	0.287	0.306	nd	Hardened and ground steel	0.100	0.096	0.098
Formica*	0.129	0.136	0.139	Ground cast iron ..	0.130	0.118	0.114
	0.112	0.119	0.123	Scraped cast iron ..	0.137	0.130	0.130
	0.151	0.222	0.220	Hardened and ground steel	0.124	0.123	0.123
Teflon†	0.037	0.079	0.079	Ground cast iron ..	0.074	0.051	0.046
	0.075	0.070	0.070	Scraped cast iron ..	0.114	0.096	0.098
	0.123	0.102	0.087	Hardened and ground steel	0.123	0.096	0.079

* Typical of "hard" plastic. † Typical of "soft" plastic.

Addition of Lubricant

The addition of a lubricant increased the effect of time at rest. Data illustrate that static friction in the lubricated tests varied to a greater extent than in the dry tests, and that increases in load decreased the variation. This is logical, since, in the lubricated tests, extrusion of lubricant from the interface occurred in addition to the plastic deformation and atomic migration present in the dry tests. Each material combination produced different rates of change in static friction mainly because of the difference in surface conditions. Teflon-type materials exhibited the largest rates of change in static friction because of the low yield-strength of Teflon. This can be accounted for by the restricted extrusion of lubricant as a result of the conforming of the plastic to the surface irregularities

of the metal slide. In contrast, the metals, having greater yield-strength, would better maintain original surface profiles and thus provide for a less restricted extrusion of the lubricant. The harder plastics are intermediate, because of yield-strength lower than cast iron or aluminium-bronze, but higher than the Teflon-type plastics.

Surface profiles and plastic yield stresses of the materials account for the difference in the rate of change of static friction with time. Those materials

TABLE 2.—*Coefficient of Static Friction—After 20 Minute Rest.*

Load.	Cast iron.	Aluminium-bronze.	Formica.	Teflon.
30 lb. per sq. in.—Dry ground cast-iron slide ..	0.330	0.270	0.130	0.070
50 lb. per sq. in.—Dry ground cast-iron slide ..	0.360	0.270	0.130	0.070
10 lb. per sq. in.—Ground cast-iron slide — lubricated	0.110	0.095	0.020	0.070
50 lb. per sq. in.—Ground cast-iron slide — lubricated	0.330	0.270	0.130	0.055
30 lb. per sq. in.—Scraped cast-iron—lubricated ..	0.140	0.195	0.135	0.090
30 lb. per sq. in.—Hard and ground steel—lubricated	0.122	0.100	0.120*	0.105

with low strength, such as the Teflon group, deformed plastically to conform to the surface profile of the slide. For lubricated tests, this mating of the surface would provide maximum resistance to extrusion of the lubricant, while the materials with higher strength would maintain a surface profile which would tend to remain unchanged, and provide a lower resistance to lubricate extrusion. Accordingly, with aluminium-bronze and cast iron the extrusion resistance would be minimum.

TABLE 3.—*Effect of Wear on the Static Coefficient of Friction.*

	Initial wear.	Continued wear.	Stability of static friction.
Formica—Dry	+*	0	Fair
Lubricated	−†	0	Good
Wayalloy—Dry	+	+	Poor
Lubricated	0	0	Good
Bearing bronze—Dry	+	+	Poor
Lubricated ..	+	+	Poor
Cast iron—Dry	+	+	Poor
Lubricated	+	+	Poor
Panelyte—Dry	−	+	Poor
Lubricated	−	0	Good
Glass-filled Teflon—Dry	+	0	Fair
Lubricated ..	+	0	Good
Teflon—Dry	+	0	Good
Lubricated	0	0	Good
Graphite-filled Teflon—Dry ..	0	0	Good
Lubricated	−	0	Good

* + = increased friction " μ."
† − = decreased friction " μ."

The breakaway characteristic of a material is dependent on the difference between the static and kinetic friction. An interesting phenomenon was obtained in the analysis of the time-displacement charts. The materials exhibited velocity variations which in turn indicated slowing down. A deceleration would require a kinetic coefficient of friction higher than the static coefficient of friction. Although this is contrary to most of the current friction theories, accuracy checks on the system only confirmed this phenomenon. Further investigation into this behaviour is warranted.

However, it is often found when taking power data on machine-tool drives that there is an instantaneous power increase. This can also be experienced in cranking the handwheel of a machine-tool slide with one hand, when suddenly both hands are required to overcome a " rough spot " or "sticking." The generally-accepted explanation is usually that of " poor fit " or " lack of lubrication " or " loose particles." These results indicate that there is not just one value of kinetic friction for flat surfaces, but that it is possible for the slider to operate under a situation in which the kinetic friction momentarily is larger than static friction. Roughening of the interface due to plastic deformation, the matching and interlocking of the interface, and the effect of regions of severely strain-hardened metal near the interface will contribute to the observed variations of the coefficients of friction.

Summary

The results described are based upon 2,800 individual tests, exclusive of preliminary tests. Utilization of the flat sliding-surface apparatus has yielded information on the effect of initial wear and time at rest on the coefficient of static friction. Time-displacement records provide a means of analysing the breakaway and kinetic friction.

The work covered in this paper was sponsored by Kearney & Trecker Corporation and conducted in the Mechanical Engineering Laboratories of Marquette University. E. J. Weiter carried out this project in partial fulfillment of the requirements for the degree of Professional Engineer at Marquette University.

Revised British Standard

The British Standards Institution has recently published a revision of BS 357:1958, the standard which deals with travelling jib cranes (power-driven, rail-wheel-mounted, on low carriage) of the following types:—Non-shunting; shunting, free on rail; portable type; and any of the aforesaid using outriggers or with part slewing. The purpose of this revised publication is to indicate minimum constructional requirements and to ensure reliability and safety in use. It places no restrictions on the general design of cranes or on the methods employed in their construction.

Safety in operation is given special emphasis, and clauses specify detailed requirements for guarding, brake-magnets, electrical protective gear and limit switches. The method of calculating forces in steel members in the crane structure now refers to the recommendations contained in B.S. 2573 " Report on permissible stresses in crane structure," and the principal of using a factor of safety has been discharged. The original method was based on the ultimate tensile strength of the material, but now the elastic limit is the criterion.

Detailed requirements are specified for the design of the crane structure and hoisting equipment, and for brakes, electric motors, controllers and protective gear. The clause on stability has been modified and there is now only one set of co-efficients. Test requirements are tabulated for easy reference. The appendices include a full list of British Standards for materials and equipment suitable for use in manufacture, information regarding load capacity of gears, and definitions of crane speeds. Copies of this standard may be obtained from the sales branch of the Institution, 2, Park Street, London, W.1, price 10s.

French Foundry Technical Association

Programme for Marseilles Congress

The 31st congress of the *Association Technique de Fonderie*, the French foundry technical association, is to be held at Marseilles from April 27 to 30. This is the first time, it is believed, that the south of France has been the venue of a foundry conference. Appropriately, of the nine papers to be read, four deal with some phase of marine-engineering requirements. Three foundries are to be visited and it can be expected that at least one will be engaged in making castings for marine-engineering applications.

Programme

Sunday, April 27: All-day sightseeing excursion.

Monday, April 28: Technical sessions. The following papers are scheduled to be presented: "Special Cast Irons and the Possibilities of their Use in Marine Engineering," by Mr. R. F. Poirot; "High-strength Cast-steel Chain," by Mr. M. Flour; "Notes on the Manufacture and Service Performance of Castings for Marine Diesel Engines," by Mr. F. Danis; "New Heat-resisting Alloys," by Dr. A. Plesinger (Czechoslovakia); "Tests on the Dimensional Stability of Light-alloy Castings," by Mr. H. Garnier and Mr. J. J. Desherault; "Cupro/Aluminium Alloys and the Use in Marine Engineering," by Mr. Weill Couly; "As-cast Test-pieces for Light Alloys made in Chills," by Mr. A. Tatur (to be presented on his behalf by Mr. G. Mascré); "Use of Investigational Method in the Search for Technical Improvements," by Mr. A. Bonneau, and "Increasing Productivity by Work-study and the Application of New Technical Processes," by Mr. G. Delatour. Finally, the new president, Mr. J. Lainé, will summarize the lessons to be learnt from the congress.

Tuesday, April 29: Works Visits. The following concerns have thrown open their works to the members of the *Association*: Fonderie des Anciens Etablissements Groignard; Fonderies Meridionales; Fonderie Provençale, and the Ecôle Nationale d'Ingenieurs d'A. et M.

Wednesday, April 30: Whole-day visit to Arles and Baux.

Further particulars may be obtained from the headquarters of the *Association* at 2, Rue de Bassano, Paris, 16.

Sampling in Industry

A one-day conference on statistical sampling in industry, organized by the Birmingham group of the industrial applications section of the Royal Statistical Society, will be held at the Birmingham College of Technology on Wednesday, May 7. The conference is designed to appeal particularly to those responsible for production, inspection and accounting, as well as to statisticians. The speakers and their subjects are:—Mr. E. D. Van Rest (Ministry of Supply), "A survey of statistical sampling for management"; Mr. R. H. S. Lesser (Philips Electrical Industries, Limited), "Statistical sampling in the control of quality"; Mr. F. S. Campbell (ICI metals division), "Work Sampling" and Mr. H. C. Mackenzie (Bristol University), "Sampling in Accountancy."

The conference fee is 30s., including lunch, and further details and application forms can be obtained from Mr. D. Goldberg, A.E.I., Lamp and Lighting Company, Limited, Melton Road, Leicester.

Urquhart Lindsay & Robertson Orchar, Limited

The future disposal of three works in Dundee by Urquhart Lindsay & Robertson Orchar, Limited, textile machinery makers, gearing specialists and general engineers, is mentioned in a statement by the board of directors. The statement, signed by the chairman, Mr. William Walker, says:—"In order to dispel any rumours which may arise, and to give the earliest possible information to the staff and employees of the company, the directors feel it desirable to inform them immediately that the changing trends in trade require some concentration of the business in Dundee. For instance, the foundry, patternmaking, certain light-machining operations, box-making, etc., have become extremely unprofitable, particularly in view of the fact that there are similar departments in the group's factory in Leeds, also not wholly engaged.

"It is, therefore, essential that a number of departments will shortly be closed, and it is the intention of the board eventually to dispose of the Wallace Foundry, the Townshend Works, and the Bellfield Works. To remove all doubts, therefore, it is repeated that this is a concentration into the Blackness Works, which has a full order book for heavy engineering, gearing and machine-tool production for some time ahead. There is no intention whatsoever of closing the principal Dundee works (Blackness Foundry), which in future will be known at the Blackness Engineering Works."

About 800 employees are engaged at the three works concerned. Urquhart Lindsay & Robertson Orchar, Limited, are associated with Fairbairn Lawson Combe Barbour, Limited.

Parliamentary

Monopolies Report on Oxygen and other Industrial Gases

In the House of Commons last week Mr. JOHN RODGERS received a written reply from the President of the Board of Trade to his question as to what action had been taken by Her Majesty's Government to carry out the recommendations made in the Report of the Monopolies and Restrictive Practices Commission about the supply of oxygen and dissolved acetylene by the British Oxygen Company.

THE PRESIDENT replied that the Commission's conclusions and recommendations on this matter were summarized in the annual report by the Board of Trade on the operation of the Monopolies and Restrictive Practices Acts, 1948 and 1953, which was laid before Parliament on February 28, 1957 (H. C. No. 97, 1956-57 Session). H.M. Government did not propose to take any action on the majority recommendation that steps should be taken to regulate the level of the British Oxygen Company's prices and profits on oxygen and dissolved acetylene. The other matters on which the Commission made recommendations had been the subject of discussions between the Board of Trade and the company, and the company had, at the Board's request, given certain undertakings on these points. Copies of a statement giving full details of the agreement which had been reached were available in Vote Office and the statement would be published in the *Board of Trade Journal* for March 28.

Foundries in the East Midlands

The fifty-fifth annual conference of the Institute of British Foundrymen, to be held this year at Buxton from May 13 to 16, has been extended by one day to enable the programme to include two sets of works visits and thus more establishments will be receiving guests. Buxton's central position offers ready access to the great foundry centres of the north and east Midlands. Derbyshire foundries produce a very high proportion of the country's tonnage of iron castings and it is only to be expected that the iron foundries take pride of place in the works to be visited. Despite this, non-ferrous founders are well catered for, as exemplified by the smaller shops of Trent Foundries, Limited, and on the other hand, the larger railway workshops of British Railways at Derby. Both large and small, specialized and jobbing foundries have opened their doors to the visitors and the following accounts of the works give a "bird's eye view" of the type of foundry, equipment, and methods practised. It is hoped that they will help members to decide to which works they wish to go—there is something new in each.

Trent Foundries, Limited

Trent Foundries, a small non-ferrous shop in North Staffordshire, was formed as a partnership in January, 1940, and became a limited liability company in 1943. Its directors consisted of practical men, moulders and a patternmaker respectively. The premises were situated in the village of Wolstanton, Staffs, until the latter part of 1956, when the business was transferred to larger premises at Longbridge Hayes, Staffs. The present site is by no means fully developed as yet and, in fact, the foundry is only now settling down after the upset of moving. With a view to extending activities, probably into the shell-moulding and gravity-die-casting fields, the original directors decided to link themselves with Solar Industries, Limited Group, and this was effected in 1956.

The works at Longbridge Hayes covers an area of 67,500 sq. ft. and employs some 51 people. The foundry, which covers an area of 13,248 sq. ft. and employs 33 people (including 20 skilled, 7 semi-skilled and 6 unskilled) is engaged mainly in the manufacture of sand castings in a large number of non-ferrous alloys and aluminium, and is operated on what is essentially a jobbing basis. The class of work is very varied and large runs are few and far between; thus, improvisation plays a big part in producing castings economically. Castings from a few ounces to 25-cwt. in weight (Fig. 1) are produced. It is hoped that at the time of the visit by Institute of British Foundrymen members, some of the larger and more interesting jobs will be on hand, however, trade governs this point. If the foundry specializes at all, it can claim to have a very good knowledge in the production of manganese-bronze and aluminium-bronze castings. The melting plant (Fig. 2) used and the mould-drying plant are both oil-fired, and visitors will see all the usual foundry appliances and machinery, such as moulding machines and CO_2 gassing plant.

The firm has no special apprentice scheme as they have had great difficulty in the district in getting boys into the foundry industry. However, times are getting easier in this direction and the firm are determined to encourage recruitment with all the means in their power. A small canteen and excellent washing and shower-bath arrangements have been provided for the employees and the firm feels that this set-up compares favourably with much more elaborate arrangements without "costing the earth."

Butterley Company, Limited

The Butterley Company, Limited, near Derby, was founded in 1790. The firm is principally interested in most types of heavy engineering but, unfortunately, time will not permit of the Institute of British Foundrymen members seeing all their various activities. The chief items of interest which the visitors will see will be a group of iron foundries, producing high-grade Meehanite (iron) castings from a few ounces up to a maximum weight of 20 tons. The foundry group consists of three sections: a fully-mechanized plant for the small castings; a semi-mechanized plant for those of medium weight, and a heavy jobbing foundry (Fig. 3) which also produces the main castings for presses and cranes.

Apart from the foundries, the other sections of the works which are to be visited will be the constructional department, where all types of road and railway bridges, heavy structural steelwork of welded and riveted construction and electric overhead-travelling cranes are built. Several bridges and cranes will be available for inspection by the IBF parties. Tours will also be made of the machine shop, fitting shop, and patternshop. In the second shop will be seen a range of sheet-metal working machinery, comprising presses and guillotines, also many other different types of finished products (Fig. 4).

Members will also pay a visit to the foundry school which has been operating for 10 years. Here, special courses for apprentices employed by the

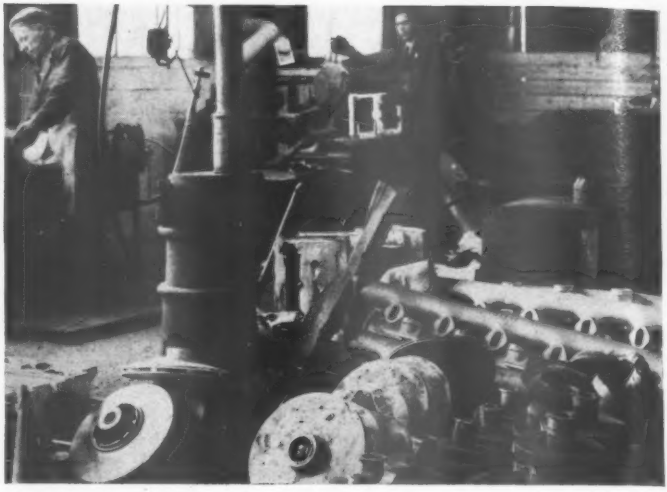

FIG. 1.—*Type of castings produced at Trent Foundries, Limited, is indicated in this photograph of a section of the dressing shop.*

various UK Meehanite licensees are arranged. There is an intensive apprentice training scheme in all branches of the Butterley works and approximately 120 young men are presently receiving technical and craft training.

A new type of oxygen-generating plant will be on view, as the company now manufactures the whole of their group's oxygen requirements. Oxygen is distributed by pipelines around the works and in cylinders to other branches and subsidiary firms.

Approximately 800 people are employed in the various sections at Butterley. Very modern and hygienic washing, bathing and changing facilities are available in the new ablutions centre for the foundry personnel, numbering well over 200. This centre was opened last year by Mr. Robert Carr, M.P., Parliamentary Secretary to the Ministry of Labour.

Ley's Malleable

Ley's Malleable Castings Company, Limited, of Derby, are the largest malleable-iron producers in Europe, and supply blackheart and pearlitic grades of malleable iron for which their trade names of Black Heart and Lepaz are well known. The firm has been producing blackheart castings for more than 80 years and employs some 2,500 workpeople at Derby. The works extend over an area of 40 acres and includes foundry buildings and annealing, core-making and finishing shops; there are also well-equipped wood and metal patternshops.

The great variety of work undertaken and quantities-off result in a diversity of methods of moulding and production. Practically every type of moulding machine is utilized, and a little floor and bench moulding is also carried out. The individual weights of castings produced range from ¼-oz. to 150-lb.

Foundries

A mechanized foundry (Fig. 5) produces the lighter class of castings, using magnetic moulding machines. The metal for this plant is duplex melted in water-cooled well-less cupolas, feeding a nose-tilting electric-arc furnace with a hot metal capacity of 3 tons, which provides continous metal for pouring moulds carried on the pallet conveyor. In the general foundries many layouts for the larger jobs involve roller-conveyor storage banks for moulds to suit batch melting of metal. Here metal is melted in pulverized coal-fired air furnaces of 20 to 25 tons capacity, each operating furnace making two heats a day. The large air furn-

FIG. 2.—*Battery of eight crucible melting furnaces at Trent Foundries. Two tilting furnaces are shown at the end of the shop.*

aces are equipped with waste-heat water-tube boilers which provide steam for electricity generation and space heating the power being produced by turbo generators. There are two central coal-pulverizing and distributing plants; coal is also pulverized for individual furnaces in Atritor mills.

Apart from a continuous mill in the mechanized foundry, moulding sand is batch milled in mixers and some sand mullers are in use on individual layouts. Synthetic sand is used almost exclusively. The coreshops are equipped with gas-fired continuous vertical stoves and a large number of cores are blown (over many years core-making practice at Ley's has reached a very high standard of efficiency). Rollover and draw machines are used for stripping the largest cores.

Annealing is done electrically, using two-stage elevated radiant-element furnaces (Fig. 6) and four separately-controlled heating zones are used; treatment is also carried out in pulverized coal-fired bogie-hearth ovens. Stations where the castings are packed for annealing are equipped with hydraulic lifting platforms and the packing material itself is mechanically handled, overhead-travelling cranes being employed to load the packed castings on to the bogies.

Included in the cleaning plant are numerous Tumblast and table shot-blasting machines, and fettling is carried out on high-speed grinders and with a variety of pneumatic fettling equipment. All plant requiring such treatment is ventilated, and dust separation and collection is arranged by cyclones and bag filters; wet dust-collectors are also installed. At the end of the fettling cycle, any castings needing attention are straightened and set in closing dies, using hydraulic presses of varying capacities up to 200 tons. Inspection is carried out by normal routine methods and, in particular, much use is made of jigs and gauges, hardness testing, pickling, Magnaflux and fluorescent methods of flaw detection. In addition to the usual metallurgical laboratory, there is an air-conditioned spectrographic laboratory and routine sand laboratories.

New Mechanized Plant

A new centrally-controlled mechanized foundry plant will be nearing completion at the time of the IBF visit and the brief description which follows will serve to indicate the degree of mechanization in this particularly modern foundry. The melting unit (Fig. 7) consists of two 9-ton per hr. hot-blast cupolas; these are water cooled and are equipped with water-cooled tuyeres, continuous tapping and front slagging. The drop-bottom bucket skip-hoist charger has an automatic cycle initiated from the cabin of the 5-ton steelworks crane used for filling the bucket. A 4-ton tilting receiver and a 12-ton nose-tipping direct-arc duplexing furnace provide the continuous hot-metal supply. Two entirely separate moulding lines are being installed, one producing the lighter class of work and the other catering for a considerably heavier type of casting—the selection of moulding-box size permitting considerable flexibility in this respect. Shockless jolt/squeeze machines will be used throughout. The pouring station is so arranged to feed both lines and five ladles of 500-lb. nominal capacity will be employed. The shake-outs will be fully automatic both loading and discharging being arranged automatically. Sprue removal after cooling will take place on an oscillating conveyor. Three continuous "Platton" sand mills, each having a capacity of 30 tons per hr. will provide the sand requirements for this new mechanized plant and 200-tons storage capacity is available. The coreshop is mechanized and equipped for coreblowing and gas-fired tower ovens are installed for core drying. Welfare facilities in this new plant include a washing centre, capable of accommodating some 350 people.

FIG. 3.—*Large vessel, typical production of the heavy jobbing foundry of the Butterley Company, Limited.*

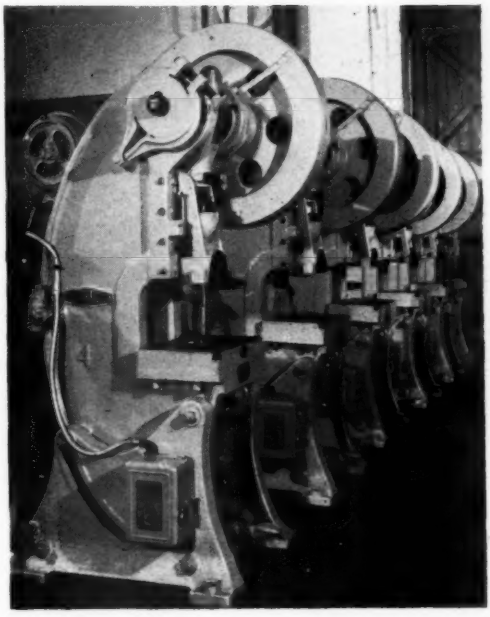

FIG. 4.—*Batch of Butterley sheet-metal presses awaiting despatch.*

FIG. 5.—*Moulding in the established mechanized foundry at Ley's Malleable Castings Company, Limited. Note the short length of roller conveyor for coreing up and the light roller conveyor (for bringing in cores) located above the pallet conveyor.*

Jackson Bros. (Milton), Limited

Jackson Bros. (Milton), Limited, of Stoke-on-Trent, was founded in 1910 by three brothers—S. R., A. E., and T. D. Jackson. They were all practical foundrymen, having served as moulders, coremakers, fettlers, and furnacemen in the early days. The only surviving brother is Mr. T. D. Jackson, now chairman of directors. The works has been on its present site for about 40 years and, due to the desire of the chairman to keep it as a private family concern, the size of the works has of necessity been restricted and the available resources have been spent on improvements and modernization to the original premises. During the last war, production was turned over to castings for the Admiralty and War Departments and extra labour was drafted to enable the firm to meet the greatly-increased demand.

Running Lines

The foundry started by manufacturing iron and aluminium castings for the pottery trade, but to-day these form a very small percentage of the output. Cast car-number-plates (in aluminium) were also produced in the past and a 24-hour supply service was inaugurated for these to any part of the country. The works, offices, stores, etc., cover an area of approximately one acre, and about 40 work-

FIG. 6.—*Two-stage elevated radiant-element furnace employed for electrical annealing at Ley's Malleable Castings Company, Limited.*

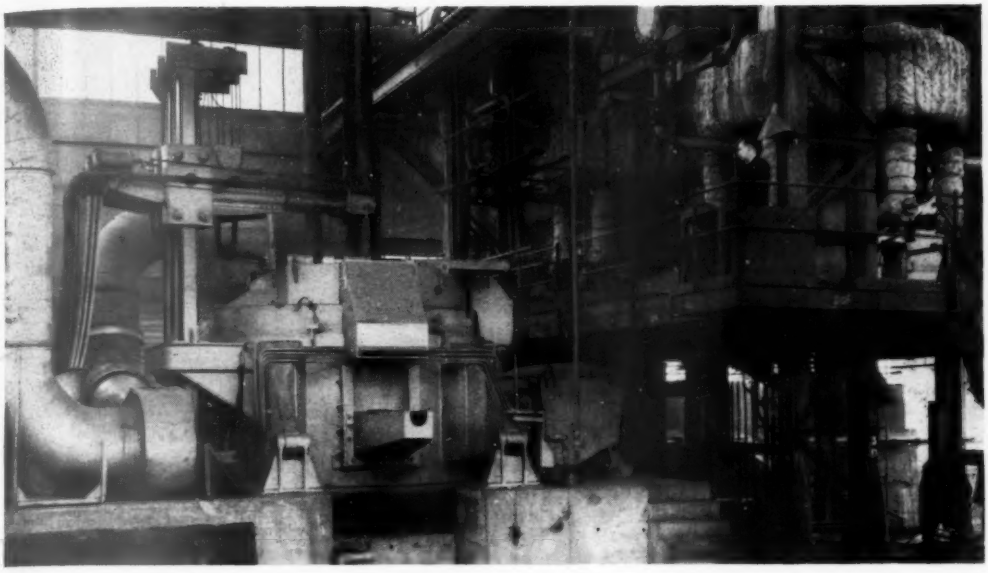

FIG. 7.—*Melting unit in Ley's new mechanized plant showing the nose-tipping direct-arc duplexing furnace and (right) the hot-blast cupolas, the lagging of which is still incomplete.*

people are employed. The present output of the foundry (non-ferrous sand casting) (Figs. 8 and 9) consists largely of castings for all fields of engineering, including marine, locomotive, electrical and mechanical, etc. It is interesting to note that the firm had the privilege of supplying some aluminium and brass castings for use on the Royal Yacht, Britannia. The weight range of aluminium castings is 1 oz. to 5 cwt., while castings from ¼lb. to ½-ton are produced in phosphor-bronze and gunmetal. Amongst the plant to be seen in the non-ferrous sand casting section are standard designs of gas- and coke-fired furnaces, both fixed and portable grinding machines, centrifugal-casting machine, bandsaws and an overhead crane.

The company was the original patentee of the method of casting phosphor-bronze rims directly on to cast-iron centres for making gears, thus eliminating the "shrinking-on" method and saving much time and expense compared with the old method. For many years this method has been found satisfactory by some of the leading gear-cutters in the country.

There is no lack of apprentices in the area and the firm has some useful and enthusiastic boys, but unfortunately the nearest technical school providing practical foundry instruction is at Stafford, some 18 miles distant. However, the foundry manager, Mr. W. Oakden, who has been with the company for 35 years (starting as an apprentice moulder at the age of 13), gives each apprentice the benefit of his long experience in the trade and takes a personal interest in each boy. The staff management is in the capable hands of Mr. K. Leedham, who has been with the company for five years.

Jackson Bros. remains at present as it started—a small family business—with everyone from the chairman to the "tea boy" showing a genuine interest in the customer's requirements. Quality, service and courtesy are the keystones of the company's trading activities. Some ten of the firm's craftsmen started with the firm as boys and have stayed with the company for 30 to 40 years.

S. Russell & Sons, Limited

S. Russell & Sons, Limited, Leicester, was established in 1864 by Samuel Russell (grandfather of Mr. S. H. Russell and Mr. P. A. Russell so well known to UK foundrymen). It commenced with a brass foundry and shortly after the foundation, the operations were transferred to Bath Lane and an iron foundry was started. In 1890, a mechanical-engineering division was formed and later, a structural-engineering division. The company throughout its history has been controlled by direct descendants of the founder, although it became a public company in 1948. The steady growth and widening scope of the company through the years has been marked by various major developments, including the enlargement of existing sites and the purchase of, and building on, a number of others. To-day, the works cover eight acres and provide employment for over 650 people, with full welfare, canteen, and sports facilities.

Foundry Division

The foundry division makes slightly more than 50 per cent. of the total of the firm and employs

FIG. 8.—*Section of Jackson Bros.' foundry showing the range of work undertaken. Valve-body patterns are in the foreground, pulleys on the right and sizeable aluminium gearcases are being inspected in the background.*

some 350 to 400 people. The foundries are in two separate units—the largest and more modern being situated at a site in Bonchurch Street, Leicester, which is about 600 yd. away from the main Bath Lane works. The former has gradually developed from a small start in 1920 and is primarily devoted to the production of castings in quantities of from 20- to 500-off for the machine-tool and general machinery trades. The melting plant here consists of two 36-in. cupolas which feed the two bays, one of which is mechanized (for boxes from 16- by 14-in. up to 46- by 28-in.) (Fig. 10), and the other produces larger castings up to 3 tons each by Sandslinger and large jolter methods (Fig. 11). The capacity of this works is about 100 tons per week and a speciality is made of using all low-phosphorus iron (approximating to the composition generally used in the USA) thus giving machining properties and general soundness which are a considerable advance on the ordinary types of grey iron produced in this country. To the melting plant of this works has recently been added a 10-cwt. rocking-arc electric furnace and a 3-ton mains-frequency furnace is in the process of being installed.

FIG. 9.—*Finishing off a large mould for a non-ferrous casting preparatory to closing—typical of the larger type handled by Jackson Bros. (Milton), Limited.*

FIG. 10.—*Part of the mechanized section for the production of small castings at S. Russell & Sons Limited, Bonchurch Street works.*

Both these are for use in conjunction with the company's development of spheroidal-graphite iron. One of the features of the foundry practice is the comparatively recent development of CO_2 practice for making cores larger than can be accommodated in the firm's normal vertical type of core stove.

Bath Lane Works

The firm's other foundry, at Bath Lane, consists primarily of a special bay (commenced in 1936) for the production of alloy irons, the main melting unit originally being a 1-ton creosote-pitch-fired rotary furnace. This foundry mainly utilizes hand-moulding methods, but some simple moulding machines are also installed. In fairly recent years, a basic-lined water-cooled cupola has been put in for the production of s.-g. iron, and the bulk of the company's production of this metal is at present made here. Also, still in operation here, there is the remaining section of the older grey-iron foundry which produces castings up to 3 tons by normal hand-moulding dry-sand methods.

Other Departments

The fettling shops at both foundries are fully equipped with shotblast plant and—at the Bon-

FIG. 11.—*A section of the heavy jobbing section of the Bonchurch Street works of S. Russell & Sons. In the top background can be seen the sand-supply belt with a movable take-off plough.*

FIG. 12.—*General view of the bay in International Combustion, Limited's, foundry where the small to medium type of casting production is handled. Note the considerable use made of swinging jib cranes and the extensive use of conveyors to keep moulds off the floor.*

church Street works—various systems of dust-extraction will be seen by the visiting parties. There is a well-equipped patternshop which, an addition to normal maintenance and new patternmaking work, is responsible for the production of special patternplates used in the mechanized foundry, including epoxy-resin plates. There is a plaster matchplate section in this department. The laboratory is also an important section of the foundry and in addition to the ordinary analysis methods and testing machines, a Fuess spectroscope may be seen.

The works heat-treatment department has been greatly expanded to meet the requirements of s.-g. iron production and now is equipped with a wide range of gas and electric furnaces—the largest being a bogey hearth furnace 10- by 6-ft. 6-in. Several furnaces are programme controlled for 24-hr., floor-to-floor annealing.

One of the main features of the company which the visitors will note is the very wide range of products made in the foun-

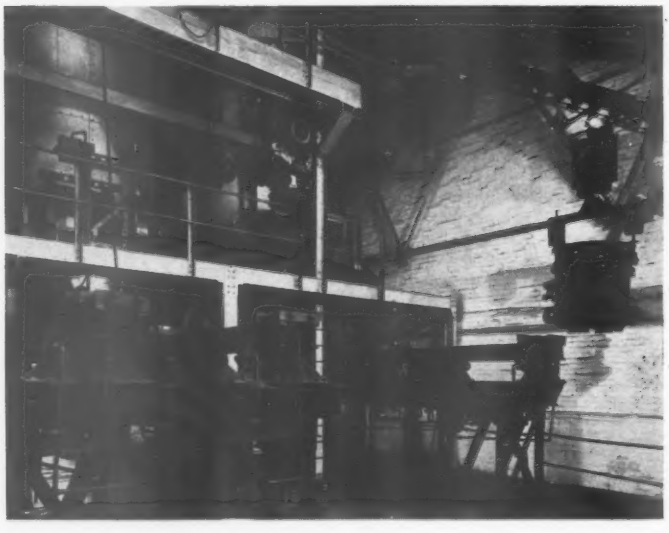

FIG. 13. — *Cupola-charging arrangements utilizing drop-bottom buckets, each with a weigh-scale carried on an endless chain. The material buckets discharge into charge buckets at the cupola door selected by the operator at the control pulpit. In turn, these charge buckets are pushed into one or other of the three furnaces by the mechanisms shown in the foreground. (International Combustion, Limited).*

FIG. 14.—*General view of one of the bays at Aiton's (Derby), where large pipes and specials are produced.*

dries both as regards to size and the metals cast. Special attention is given to s.-g. iron production, and of this metal the company is one of the major producers in Great Britain. S.-g. iron castings from a few ounces to approaching 2 tons are made, and various methods of adding the magnesium to the iron are employed in the processing.

International Combustion, Limited

Although some of the constituent firms can claim a much longer existence, the organization now known as International Combustion, Limited, dates from 1923, when a company under the title of Vickers and International Combustion, Limited, was formed jointly by Vickers, Limited, and the International Combustion Engineering Corporation of New York; primarily for the purpose of developing pulverized fuel as a means of firing water-tube boilers. In 1925, the name of the company was changed to International Combustion, Limited. Over the ensuing decade, the New York influence waned and finally disappeared in 1934, when the various subsidiaries became consolidated into one company. The works at Derby cover some 60 acres with 558,500 sq. ft. of floor space; 250,000 sq. ft. are used for open working space and outside storage. Derby was selected as the site for the works entirely on economic grounds—the land was then relatively cheap and the town was geographically central in good rail communication with all parts of the country, thus minimizing transport costs. Some 208 are employed at the foundry and of these there are 42 skilled and 74 semi-skilled. Foundry and patternshop together occupy 67,000 sq. ft. of floor space.

The foundry was laid down in 1922 and on November 6 of the same year the first casting was poured. At this time, the shop was about two-thirds the existing length and mechanization was very limited. All moulding was done on the shop floor and the output varied between 30 and 40 tons per week. Metal for the entire shop was melted in two cupolas rated at 10 tons per hr. each and situated in No. 1 bay. In 1928, the shop area was increased by about half and a sand-preparation plant installed. Due to the large demand for castings in the power-plant industry in 1931, the foundry was probably the busiest shop in the works, and snap-flask moulding was becoming very prominent. The pattern-store, at that time, carried upwards of 25,000 patterns, all of which were in regular use. As the years went by, foundry output was still rising and it was thus found necessary to introduce further mechanical aids. The entire foundry layout was reviewed in 1951 and a suitable scheme was finalized. During the past six years, many

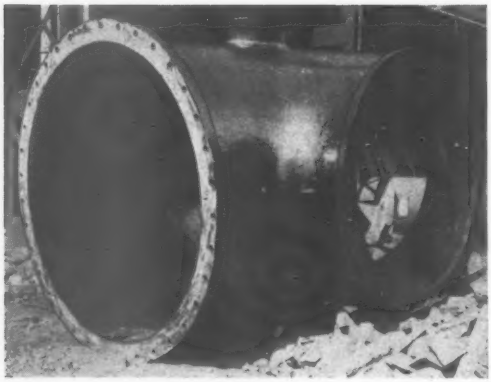

FIG. 15.—*Typical example of a large special-pipe casting produced with a minimum of patternwork. (Aiton & Company, Limited.)*

modifications have been carried out*—the scheme is about three-quarters completed and future installations include the core-delivery conveyor, annealing oven and new sand-distribution plant above and below ground.

The patternshop, in which wood or metal patterns for all cast components produced by the firm are manufactured, is equipped with the latest woodworking machinery. The foundry produces large single castings up to a maximum of 15 tons and sizes up to 14-ft. dia. or many thousands of small castings which go to make up such finished products as the louvre stoker grates and economizers (see Fig. 12). The small castings are produced on various types of continuous-casting plant, of which the large conveyor system was one of the earliest examples. Recent developments in the foundry concern cupola-charging equipment shown in Fig. 13.

Mains-frequency Furnace

In the foundry is the first production model mains-frequency coreless induction furnace to be installed in this country; this is of 5-tons capacity and is used mainly as a holding and superheating unit for cupola metal in the production of special cast irons, including spheroidal-graphite iron. Close metallurgical control is one of the features of this furnace and a new foundry laboratory, to test on the spot day-by-day working of the furnace and, indeed, the foundry generally, has been constructed alongside the furnace.

The overall capacity of the foundry is of the order of 200 tons per week. There are four cupolas, one of 10-tons per hr. melting capacity and three each of 6 tons per hr. The continuous moulding plant produces about 65 tons of small castings per week; large floor-moulded castings made in No. 2 bay total about 100 per week, while the machine moulding and roller conveyor plant in No. 3 bay produces about 6,000 items weekly.

Showerbaths, etc., are provided on a lavish scale for the foundrymen, so that there is no need for the men to go home in their working clothes.

Other Departments

The firm's machine shop takes the products of the foundry and rolled or drawn material from the store to produce components of many varied sizes and shapes for assembly into finished products. There are many fine machines to be seen and the tools for both machine and manual working, together with the essential gauges to ensure correct sizing, are produced in the firm's well-equipped tool-room which adjoins the machine shop. Assembly of components is carried out in the erecting shop, which is served by the same cranes as those serving the machine shop, which simplifies handling considerably. Here will be seen almost all the company's industrial products in various stages of construction, although the large size of the modern boiler units means that most of the erection on these is done at site.

In the firm's general laboratories are located concentrated facilities for non-destructive testing of metal fabrications (ultrasonics, X-rays, gamma rays, and magnetic testing, etc.), mechanical and metallurgical investigations of metals, fuel analysis, spectrographic control of metallic products, and general analysis of materials relative to the manufacture of large steam-generating units, nuclear and chemical plant, etc.

Range of Work

Individually, the largest product of the company is water-tube boilers, particularly in the huge sizes used in power stations. The firm has pioneered many types of firing equipment and the method of burning pulverized fuel by tangential firing originated with the company. Other equipment produced includes all types of grinding, screening and mechanical-filtering equipment, together with vibrators of both electrical and mechanical types. Laboratory screening and grinding equipment is also manufactured and a good deal of pioneer work has been done in particle-size determination down to the smallest micron sizes. By far the majority of the firm's production, however, is given up to the manufacture of general steam-generating equipment, particularly for the combustion of fuel in the form of powdered coal or of travelling-grate stokers. More recently, the manufacture of oil-burning equipment of all types has been introduced, and there have been developments associated with nuclear-energy projects, some involving quite large castings.

Amenities for those employed at the works are provided in the form of a fully-equipped canteen with a fine kitchen; a sports ground with facilities for football, cricket and tennis, and there is also a sports pavilion. Some distance away is the Works Social Club, standing in its own grounds, with bowling greens, tennis courts and provision for all indoor sports and concerts, etc. (Sections of the works of

* In recent years, the JOURNAL has contained a number of reports of developments at International Combustion, Limited, including "Conversion of Cupolas from Cold to Hot Blast, and Operating Economies," January 5, 1956, and "Melting Facilities Get Priority," April 11, 1957.

particular interest to foundrymen have been covered in this short account, but it should be pointed out that in addition there are, of course, large plate shops, tube shops, header shop, forge, erection and test house.) The drawing office alone employs over 200 people.

Aiton & Company, Limited

Aiton & Company, Limited, Derby, have been producers of high-quality pipework for over 50 years. The firm was established in Willesden in the year 1900 by the late Sir Arthur Aiton for the production of fabricated-steel pipework. In 1907, due to lack of space at the Willesden site, the works were removed to Derby and, at this stage, a foundry for making cast-iron pipes was installed. The works have been extended from time to time, and in 1936, a new foundry was built to the design of the late Mr. R. S. Cook. The layout was specially conceived for the production of grey-iron pipes from 2-in. up to 72-in. dia. with a maximum weight of 8 tons. Two further extensions to the foundry have been completed since the last war, giving a total area of 31,000 sq. ft., and an annual output of over 2,000 tons. (See Figs. 14 and 15.)

Patternwork Kept to a Minimum

Piping is produced by the shell-connection method, which keeps patternmaking to a minimum. For this, the moulder is supplied with a flat template representing the cross-section of the pipe and from this, with the aid of an iron "shell," he builds up the complete mould and core. In addition to pipework, various castings are produced associated with distilled-water evaporator plants of several types being built by the company.

Most of the skilled moulders employed by the firm have grown up with the company and a strong apprentice school is in operation to ensure a steady intake of trained moulders. Amenities at Aiton's are good; baths for the foundry employees were installed before the Regulations making them compulsory came into force. Canteen facilities are also adequate.

(Other foundries to be visited will be described shortly in the JOURNAL*)*

Book Review

Siemens Brothers, 1858-1958, by J. D. Scott. Published by Weidenfeld and Nicolson, 7, Cork Street, London, W.1; price 35s. net.

Perhaps due to the growth of manufacturing consequent upon the holding of the "Great Exhibition of 1851," the last few years have yielded a number of works' centenary books. This one, however, differs from many as the author has a wide basic knowledge of the industrial development of the country. Thus, the reader is given the progress of this great enterprise against the background of the prevailing economic conditions over the period covered.

Most foundry people associate the founder of this company—later to be Sir Charles William Siemens, D.C.L., LL.D., F.R.S.—with the invention of the regenerative open-hearth furnace, but in the field of electrical engineering, he was equally famous. The foundation of his success was the sale to Elkingtons, of Birmingham, of an invention covering electro-deposition for £1,600.

The book is divided into six parts, the first of which deals with "The Founder and the Foundations," in which the story is told of the beginnings of both land and submarine cables. In Part II, "Finance and Organization" are covered, and here, much is disclosed about the great German firm of Siemens and Halske and its association with the Woolwich concern; there is a section on cartelization in Germany which is not without interest to-day. The impact of the 1914 war on the business was serious, as the firm had much German capital invested in it, a German managing director and quite a few German employees. In practice, it meant a complete severance between English and German interests. By 1939, only a few shares belonging to Siemens and Halske had to be expropriated. Parts III and IV of the book, respectively, deal with technical developments and capacity and production, whilst Part V covers "War: The Mobilization of Effort." The reviewer finds this less of an individual story because, like all other firms, Siemens was controlled by the State and just had to produce goods at the Government's bidding. Part VI—"Labour Relations"—the reviewer found more interesting as it discloses upon what slender bases these can depend, such as a clash of personality between a foreman and a shop-steward. There are four informative appendices, followed by a comprehensive index.

New Catalogues

Pipe Transport. Of interest to pipe founders is a folder (No. BS/IA/58) received from the British Straddle Carrier Company, Limited, 95, Wigmore Street, London, W.1, as it describes and illustrates a diesel-driven lorry which carries its load of pipes, girders and planks in an open-ended container located a little above ground level and beneath the driving cabin. In addition there is a jib-crane attachment which either places the pipes into the container or extracts them and stacks them in the stockyard on railway trucks. Under differing loads it is scheduled to travel at either 12 or 25 miles per hour.

Wire Ropes. British Ropes, Limited, Carr Hill, Doncaster, and elsewhere, have issued three catalogues—"Wire Ropes" (No. 25); "If Rope could Talk" (No. 72); and "Superloop." The first tells something of the construction and range of wire ropes, of which there is a wide variety. It is the second one which is commended to the notice of the foundry industry for in it there are a number of useful tips, the following of which will prolong the life of the rope and may prevent unexpected failure. The third publication tells all about Superloop, which is a mechanical splice using a new type of slimmer tapered sheaf.

Unit Dust Collector. Prat-Daniel (Stanmore), Limited, Whitecroft, Nailsworth, Glos., have used a leaflet to describe and illustrate the Bahco wet cyclone dust-collector, said to employ an entirely new method of water washing. It is a transportable machine embodying a cyclone system and having a low water consumption which can be placed near a grinder or other machines. As the dust-free air is returned to the shop it is claimed that the equipment does not interfere with the space heating.

Foundry Goggles . . . FIRST REPORT OF THE JOINT ADVISORY COMMITTEE

(*Continued from page 331*)

Following the main report of the Joint Advisory Committee on Foundry Goggles and that of the sub-committee, both of which have already appeared in the JOURNAL, *a further contribution is made to the study in a second appendix. In this, Major A. M. Reid, B.Sc., describes the experimental procedure employed in a series of laboratory ballistic trials designed to establish the relative strengths of a range of goggle lenses. Because of the severe nature of the tests the data which they yielded and the conclusions drawn from these results represent a valuable complement to the findings of the sub-committee described earlier.*

APPENDIX II

Laboratory Ballistic Trial of Goggle Lenses

*By A. M. Reid, B.Sc.**

Introduction

The object of the work was to investigate the impact strength of various lenses and select from them by ballistic trial the one most suitable as a replacement in an existing type of goggles.

Experimental Work

Materials

The existing equipment consisted of a pair of goggles having $\frac{3}{16}$-in. "Perspex" lenses fitted into an aluminium alloy frame. Each lens consisting of a front and side was constructed in one piece, chamfered on the inside, and bent over at right angles to give a smooth and bevelled corner junction. This method of joining has the marked advantage of retaining the maximum field of view through the lens, the junction appearing as a thin line. This is in marked contrast to the obscuring bar due to refraction obtained when the front and side pieces of the lens meet at right angles without a 45 deg. facing bevel. The goggles were designed to fit all facial contours and had vent holes on the side portion of the lens and on top and bottom of the alloy frame, inclined to the rear to prevent grit and sand entering the eyes directly as a result of an explosion. The head harness was adjustable and could be fitted over small ordinary spectacles. The weight of the goggles was 4 oz.

After examination of several materials suitable for lenses, it was decided to investigate ballistically various types of lenses in laminated glass and laminated "Perspex." Messrs. Triplex Safety Glass Company, Limited, were approached and through their co-operation and generosity the following lenses, six of each, cut to the shape of the front piece of the goggle frames, were obtained for test purposes:—(1) Three-ply "Triplex" glass with $\frac{30}{1000}$ in. soft "vinyl" in each laminated, bevelled but not notched. (Thickness 0.215 in.) (2) Two-ply $\frac{1}{4}$ in. toughened laminated glass with $\frac{45}{1000}$ in. soft "vinyl," bevelled and notched. (Thickness 0.270 in.) (3) Two-ply $\frac{1}{4}$ in. toughened laminated glass with $\frac{45}{1000}$ in. soft "vinyl," not bevelled and not notched. (Thickness 0.266 in.) (4) Two-ply laminated "Perspex" and $\frac{1}{8}$ in. soft "vinyl" interlayer bevelled and notched. (Thickness 0.286 in.) (5) Two-ply "Perspex" with $\frac{30}{1000}$ in. soft "vinyl" interlayer, bevelled and notched. (Thickness 0.285 in.) (6) Two-ply "Perspex" with $\frac{60}{1000}$ in. soft "vinyl" interlayer, bevelled and notched. (Thickness 0.295 in.) (7) Three-ply "Perspex" with $\frac{30}{1000}$ in. soft "vinyl" interlayer, bevelled and notched. (Thickness 0.3125 in.) (8) Three-ply "Perspex" with $\frac{60}{1000}$ in. soft "vinyl" interlayer, bevelled and notched. (Thickness 0.295 in.)

The firm was asked not to exceed $\frac{5}{16}$ in. for the overall thickness of the lenses. To achieve this, the Perspex thickness was varied to accommodate the varying thicknesses of the "vinyl" interlayer. The firm used its own methods for bonding the interlayers of "vinyl" with the glass and the "Perspex."

FIG. 8.—*Laminated plastics goggles after high-speed ballistic test, showing the projectiles embedded in the lenses which have withstood the impact.*

Laboratory test

The trial was conducted in two phases:—(*a*) The selection of the two best types of lenses of the eight available by a comparative ballistic test, and (*b*) a repeat of the ballistic test with the chosen lenses fitted in the goggles, replacing the original

* The Author is connected with the Clothing and Equipment Physiological Research Establishment of the Directorate of Physiological and Biological Research, Ministry of Supply.

lenses of single thickness of " Perspex," with a view to selecting the best type.

The ballistic test required had to be reasonably consistent in velocity up to 1,000 ft. per sec. and the missile had to be fired with fair accuracy, the target area of the lens being approximately 2 by 2 in. Advice was sought from various authorities on how best to conduct the ballistic test with a low-velocity fragment-simulating projectile. In the interest of consistency, it was eventually decided to use a steel cube as the missile, this being possibly closest to a " standard " fragment. A weight of 17 grains (about 1 gm.) was chosen to be in line with the projectile used in the test in which the original lens failed. Helpful suggestions were obtained from many sources, but it was disappointing to learn that there was no available technique in current use which could produce sufficient accuracy at the low velocities required with the type of projectile proposed. Facilities to carry out the tests were very kindly given by the Fighter Development Branch of the Royal Aircraft Establishment and that Branch also provided the invaluable aid of a Range Officer of long experience. Various weapons were tried, including the 0.303 rifle, a revolver, a saloon rifle, and a shot-gun with cartridges variously loaded and using different explosives before finally deciding on the 0.410 shot-gun as the most appropriate for the test. I.C.I. Limited very generously provided all the ammunition, except the missiles, in broken-down form, together with a crimping tool for sealing the cartridge. Coarse black powder was used as the propellant.

The cartridge was loaded as follows:—A measured quantity of powder, very small in relation to the size of the cartridge, was put in the case first, followed in turn by an air-cushion wad, a cardboard cylindrical distance piece, a further wad with the missile centred on it in a small blob of wax and a final cylindrical distance piece to take up the remaining space to the head of the case. The cartridge was then closed in the vice, using the crimping tool. To ensure comparable closure the case was placed in an aluminium-alloy sleeve which in turn fitted into a socket suitably recessed to prevent the cap of the cartridge firing when the vice was closed on the assembly. The vice was turned until the crimping tool reached the top of the sleeve.

TABLE 25.—*Results of Tests carried out with Lenses of Various Composition.*

Further tests were done with (*a*) a No. 8 lens fitted on the original " wooden " rig in front of a pig's eye, with no intervening glass spectacles, and (*b*) a repeat of (*a*), with a No. 2 lens (laminated toughened glass) and a No. 1 lens (" Triplex ") in place of the No. 8 lens; (*c*) the original goggles in position on the full " head " rig; and (*d*) the No. 8 lens goggles positioned on the head, without spectacles behind. Time base—3 ft.

Serial No.	Weapon and rig used.	Charge.	Chronometer reading in sec.	Lens.	Muzzle velocity.	Accuracy.	Remarks.
1	0.410 shotgun Wooden structure and pig's eye	0.32 gms. Black Powder	0.00419	No. 8	716 ft. per sec.	Poor	No penetration; projectile bounced-off; splinters on eye, which washed off.
2	Do. Wooden structure and pig's eye	Do.	0.00396	No. 8	757 ft. per sec.	Very good	Dead centre of " Perspex." No penetration; projectile bounced off; few splinters on eye, which washed off.
3	Do.	Do.	0.00416	No. 2 lens (Toughened glass)	722 ft. per sec.	Very good	Projectile bounced off; masses of glass splinters impinged on the eye and badly cut the mucosa, but there was no leakage of aqueous humour.
4	Do.	Do.	0.00349	No. 1 lens (" Triplex ")	862 ft. per sec.	Fair	Low shot which completely penetrated, throwing splinters into the eye which was already destroyed by projectile.
5	Do. Head rig and pig's eye	Do.	0.00352	Original $\frac{1}{8}$ in. " Perspex "	852 ft. per sec.	Very good	" Perspex " lens and spectacle lens smashed to pieces. Projectile penetrated to base of the eye socket and was stopped by metal of the head.
6	0.410 Head rig and pig's eye	0.2 gms. (approx.)	0.00504	Original $\frac{1}{8}$ in. " Perspex "	597 ft. per sec.	Fair	Low shot; " Perspex " lens and spectacle lens smashed; projectile penetrated through the eye to the metal base.
7	Do. Do.	0.32 gms.	0.00443	No. 8 lens	677 ft. per sec.	Good	No spectacles were used. A very few tiny splinters were thrown off which impinged on the eye but they could be washed off. No penetration.
8	Do. Do.	Do.	0.00384	No. 8 lens	785 ft. per sec.	Fair	Projectile struck the lens close on the nose side and just penetrated, throwing the splinters into the eye; none of which penetrated the eye.

Initially with the above-mentioned method of loading the cartridge the wads were troublesome, " following on " behind the missile and wrecking the timing screens. Velocity was measured over a time base of 3 ft., the time being recorded on a Decimal Counter Chronometer Type IA.Mk 1. The counter was started by the missile breaking a copper wire 3 in. in front of the muzzle and stopped by breaking a further grid of wires 6 in. in front of the target. To get rid of the wads an armoured plate was incorporated in the rig with a hole in it sufficient in size to allow the passage of the projectile but not the wads. The counter " starting " wire was lined across the back of the hole. Velocity values determined from the counter were shown to be higher than the actual striking value by about 4 ft. per sec.

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The target lenses were mounted in a wooden structure which could be dismantled by means of fly nuts after the lenses had been fired at, and allow of close examination of damage to the lens *in situ*. Splinters and fragments thrown off from the back of the lens, as a result of the impact, were caught on a plasticine layer approximately 1 in. behind the lens. All shots were fired at normal incidence to the target. To get some idea of the damaging effect of the splinters thrown off from the lens further tests were done with a pig's eye mounted in the wooden structure in lieu of the plasticine and successive shots were fired at the No. 8 "Perspex," the No. 2 toughened glass and the No. 1 "Triplex" lens. All shots were again at normal incidence.

Method of Testing

Triplex Safety Glass Company, Limited, were commissioned to replace the lenses of the old goggles with the two new types and 24 pairs of goggles—12 of each type—were obtained. A metal-alloy head was borrowed from Chemical Defence Experimental Establishment and orbits were drilled out in it comparable in size to an average human orbit. The artificial orbits were filled initially with plasticine, but later with real eyes. Pig's eyes were chosen because of their availability and their relative correspondence in size to human eyes. It was felt that using them as a target in the metal head would give a more realistic picture than would plasticine of the possible damage to the human eyes from the flying "Perspex" fragments.

In some tests ordinary spectacles fitted with plain glass lenses were placed on the metal head over the pig's eyes and under the goggles to prevent direct entry of splinters into the eyes. Further tests were carried out with the original goggles in position on the full "head" rig and later with No. 8 lens goggles positioned on the head without spectacles behind. All shots were fired at normal incidence. It was hoped to get direct comparison of resistance to impact of each type of lens.

Results

Using a standardized technique each cartridge was hand-made with a weighed quantity of coarse black powder as a propellant. Successive shots with the same weight of propellant could not be relied on closer than ±100 ft. per sec. of the average velocity for that weight of charge. Accuracy in the main was good with an occasional "wild" shot possibly due to the missile touching the hole in the armour plate on its way through. All lenses were completely penetrated at velocities of 1,000 ft. per sec. The results are based on a minimum of four and a maximum of six shots per type of sample lens:—

Sample No. 1 was of "Triplex" glass 0.215 in. thick. There was complete penetration at 718 ft. per sec. The penetration was accompanied by a shower of glass splinters which lodged in the plasticine placed behind the lens at 1 in. distance. Samples 2 and 3 were of laminated toughened glass, 0.270- and 0.266-in. thick respectively. The "vinyl" interlayer could withstand without penetration velocities up to 860 ft. per sec. There was, however, an accompanying mass of glass splinters which were thrown off from the layer next to the eye sufficiently fast to smash a glass lens placed between the toughened glass and the plasticine "eye." This ruled out toughened glass as a possible substitute lens. Samples 4, 5 and 6 were of laminated "Perspex" 0.286-, 0.285- and 0.295-in. thick respectively. Of these three No. 4 had most potential as a lens. The thick ¼-in. soft "vinyl" interlayer of the sample had more stopping power than the thinner "vinyl" of the other two. From all of them large fragments were thrown off on impact, sample 4 producing the largest in fragment size. No. 4 was not penetrated at a velocity of 812 ft. per sec., but threw off a splinter which embedded itself in the plasticine "eye" to a depth of ½ in. No. 5 was completely penetrated at 770 ft. per sec. and No. 6 at 743 ft. per sec.

Samples 7 and 8 were of three-ply "Perspex," 0.3125 and 0.295-in. thick respectively. The splinters thrown off from these samples after impact were smaller and fewer and the general shattering was less than in any of the other samples. No fragments of any size were thrown off at velocities up to 700 ft. per sec. when the lens was hit centrally and generally only very small fragments which lay loosely on the plasticine were thrown off up to 800 ft. per sec. A test was carried out with a glass lens between the "Perspex" and the plasticine at 735 ft. per sec. The glass lens was undamaged and stopped the few splinters of "Perspex" which were thrown off. In this part of the trial partial penetration with few splinters was obtained with velocities up to 812 ft. per sec.

The individual results of the tests, using a pig's eye in lieu of plasticine, are shown in Table 25. In the case of the No. 8 lens the few splinters which alighted on the eye could be blown or washed off. The splinters from the No. 2 lens (toughened glass) cut the outer mucosa of the eye very badly. The "Triplex" lens No. 1 was completely penetrated, the projectile completely destroying the eye. The splinters following behind penetrated the outer layer and entered into the aqueous humour. In view of the relatively small number of fragments thrown off and the reduction in the general shattering it was decided to have 24 pairs of goggles made up with the sample lenses No. 7 and 8 for further tests.

Further Tests

The rig used for these tests has already been described, and individual shots are recorded in Table 26. All shots were fired at normal incidence to the lenses. At comparable velocities (serial nos. 5, 7, 13, 25, 29 and 31 in Table 26) the tests showed that the No. 7 lens was subject to deeper penetration by the missile with more accompanying and damaging splinters when hit than the No. 8 lens. There were more instances of the No. 7 than of

TABLE 26.—*Results of Tests Using* 0.410 *Shotgun and Charge of* 0.32 *gm Black Powder on Lens Samples* 7 (*Serial Nos.* 1 *to* 16) *and* 8 (*Serial Nos.* 17 *to* 32). *The improved results recorded from Serial No.* 17 *onwards will be noted. Time base* 3 *ft.*

Serial No.	Chronometer reading in sec.	Muzzle velocity. Ft. per sec.	Accuracy.	Remarks.
1	0.00338	885	Poor	High shot. Deep but partial penetration.
2	0.00667	450	Very poor	Projectile hit junction of front and side lens. No penetration.
3	0.00373	804	Very good	Projectile bounced off. Splinters held by spectacles.
4	0.00337	890	Very good	Projectile bounced off. Small splinters held by spectacles.
5	0.00363	827	Very good	Projectile penetrated to last layer and splinters of "Perspex" broke spectacles glass and lodged on the eye-ball quite loosely.
6	0.00379	792	Good	Many splinters in bulk were thrown off. Projectile was held in the "Perspex"; few splinters ricocheted on to eye-ball.
7	0.00360	833	Good	Partial penetration of "Perspex" but the lens was broken away from its rivets and smashed the glass of the spectacles behind. The eye was not punctured.
8	0.00405	740	Good	Again lens forced off rivets. Splinters, but none on the eye.
9	0.00507	593	Poor	No penetration. Projectile hit edge at junction of front and side pieces; the side lens came adrift. Splinters on the eye washed off.
10	0.00399	753	Good	Partial penetration. Splinters larger than usual thrown off. One ricocheted on to the eye. Spectacles were not damaged. The splinter on the eye was blown off.
11	0.00405	742	Good	Partial penetration. Projectile was deeply wedged in the "Perspex." Splinters ricocheted on to the eye. Spectacles lost a small glass splinter at the rim
12	0.00359	837	Very good	Central hit; partial penetration; few splinters; none on eye. Spectacles undamaged
13	0.00369	814	Poor	Projectile hit junction of frame and "Perspex" at the top. It split "Perspex" away from rivets but was held. Spectacles were not broken. Splinters on the eye were washed off
14	0.00443	677	Good	Partial penetration; few splinters; none on the eye
15	0.00395	760	Very good	Projectile bounced off. There were many splinters; a few ricocheted on to the eyeball; they washed off
16	0.00378	795	Very good	Projectile almost through. Splinters ricocheted on to the eye. Spectacles were unbroken. Splinters were washed off
17	0.00335	896	Very good	Partial penetration. Projectile held in "Perspex" Tiny splinters very loose on the eye
18	Chronometer failed	—	Very good	The projectile tore the lens off its rivets, near the nose, and the lens smashed the glass of the spectacles behind. The "Perspex" was not penetrated
19	0.00450	667	Good	The projectile bounced off. There were no splinters behind
20	0.00331	906	Good	Partial penetration, but splinters ricocheted on to the eyeball. Spectacles undamaged. Splinters were blown off the eyeball. Two of the splinters were quite large and triangular.
21	0.00418	716	Very good	Projectile bounced off. Tiny splinters ricocheted on to eyeball. Spectacles undamaged. Splinters blown off eyeball.
22	0.00466	643	Very good	Projectile bounced off. No splinters.
23	0.00445	675	Very good	Partial penetration. Projectile bounced off. Small splinters.
24	Chronometer failed	—	Good	Projectile deep in the "Perspex." Tiny splinters on the eye. Spectacles intact. Splinters blown off.
25	0.00356	845	Good	Partial penetration. Projectile held. Splinters very small. Few on the eye were washed off. Spectacles intact.
26	0.00553	532	Good	Central hit. The side lens cracked. No penetration. No splinters.
27	0.00422	712	Good	Partial penetration; few splinters; none on the eye; projectile bounced off.
28	Chronometer failed	—	Very good	Complete penetration. Projectile inside protectors. Spectacles still intact; eye undamaged.
29	0.00370	812	Very good	Partial penetration; central hit; projectile held; few splinters.
30	0.00329	912	Very good	Partial penetration; large splinters inside protectors; none on the eye; spectacles undamaged.
31	0.00354	847	Very good	Partial penetration; central hit; fragments ricocheted on the eye; blown-off; spectacles intact.
32	0.00338	887	Very good	Projectile just held in the "Perspex." Splinters thrown off which ricocheted on to the eyeball; washed off; no damage to spectacles.

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the No. 8 lens being torn off its rivets by the impact and of the glass lens of the spectacle behind being broken (see 7, 8, 9 and 13). With the smaller number of samples it is difficult to draw conclusions from this, but there was only one instance of the No. 8 lens being torn off its rivets (serial no. 18). Unfortunately the chronometer failed on the latter shot so that the velocity could not be calculated. From observations of the effect of the missile on the lenses after every shot, it was quite clear that the lens No. 7 was more subject to damage than No. 8 at comparable velocities.

The missile of the original goggles (Table 25, serial nos. 5 and 6 at 597 and 852 ft. per sec.) smashed the goggle lenses and the spectacle glass to pieces, the projectile penetrating to the base of the pig's eye and only being stopped by the base of the metal socket. Of the two shots at the No. 8 lens without spectacles behind them, one completely penetrated at 785 ft. per sec., the lowest velocity with complete penetration, which occurred on this lens. The missile struck the goggle lenses in the area of the eye rivets and just penetrated. The splinters thrown off did not penetrate the eye and were washed off. The velocity of the other shot was low, but tiny splinters which were washed off did alight on the eye.

Assessment of Velocity at Impact

Two chronometers were used on the normal rig except that a wire grid replaced the normal target position. The first chronometer was connected to the " start " wire behind the hole in the armoured plate and to the " stop " wires 6 in. in front of the target over a time base of 3 ft. The second chronometer was also connected to the " start " wire but its "stop " wires were in the target position giving it a time base of 3 ft. 6 in. The chronometers had been checked against each other prior to the experiment being connected to the same "start" and " stop " wires. Over several tests they agreed to 0.00001 of a sec. Results obtained from calculations using the two chronometers on different time bases indicated that the velocity at impact could be taken as being approximately 4 ft. per sec. less than that calculated from the time base.

DISCUSSION

The small amount of data from the present trial revealed from the beginning that not only is there the problem of stopping a metal particle, but there is also the very real secondary hazard of preventing splinters from entering the eye from the back of a lens which has been hit. In these trials ordinary spectacles with plain glass lenses were used in some cases in conjunction with the goggles. The experiment showed that direct entry of a lens splinter into the eye could be stopped by intervening spectacles but that ricochets off the side lens entered the eye on many occasions. None of the " Perspex " splinters from lenses 7 or 8 embedded themselves in the pig's eye.

The cube shape of projectile was used in preference to a ball on the grounds that it more closely resembled a real fragment having sharp edges and corners. There is some evidence from other workers that up to the order of 1,000 ft. per sec. against non-metal targets the initial tumbling tearing action of the cube appears to give it more penetrating power than a steel ball. It was considered that its use, despite its ballistic shortcomings of variation in presented area, gave a test much more rigorous in its effect on the lenses than a ball.

The laminated-glass lenses were ruled out because of the relatively low resistance to penetration. Toughened glass which has high resistance failed because of its complete disintegration when struck and the accompanying mass of glass splinters which were thrown off sufficiently fast to smash a spectacle lens of ordinary glass 1 in. behind it. When no intervening spectacle glass was used the mass of fine splinters from the toughened glass badly cut the cornea of the pig's eye again situated at 1 in. distance from the goggle lens (Table 25, serial no. 3). Of the various types of laminated " Perspex " tested three-ply was best, since it produced fewer and smaller splinters which could be stopped by suitable spectacles as well as having more resistance than any of the others.

The test on the goggles fitted with lenses No. 7 and 8 showed that there was deeper penetration of the lens by the missile with more accompanying splinters with No. 7 than with No. 8 lens at comparable velocities. From the figures in serial nos. 1 to 32 in Table 26 there does not appear to be much to choose between them, but from observation of the effect on the lenses after every shot it was quite clear that the lens No. 7 was the one more subject to damage.

For both types of lenses the area near the nose was most vulnerable and complete penetration was effected there with a velocity of 785 ft. per sec. (Table 25, serial no. 8) on a No. 8 lens. This was the only case of complete penetration of a No. 8 lens, apart from one at 1,000 ft. per sec. recorded during the trial and was in contrast to a single shot of 912 ft. per sec. which was successfully held (serial no. 30, Table 26).

The highest recorded velocity for the No. 7 lens without penetration was a central hit of 895 ft. per sec. (Table 26, serial no. 4), but later one of 795 ft. per sec. also central on the lens was virtually through the lens. Optically the No. 7 lens is slightly superior in quality to No. 8 presumably because of its thinner " vinyl " interlayer. It is considered, however, that the No. 8 lens is still sufficiently good in optical quality for certain tasks.

Lack of sufficient numbers of lenses, the difficulty of the technique and the time involved in carrying it out prohibited extensive experimental work to obtain enough data on the limiting velocities (*i.e.* for complete penetration) for each lens and establish statistically which of the two was the superior. However, it is considered that the experiments were carried sufficiently far to produce convincing evidence to the observers that of all the lenses tested No. 7 and 8 of three-ply " Perspex "

were the best, and of them No. 8 was to be preferred for stopping flying fragments (see Fig. 8).

Conclusions

The three-ply "Perspex" lens with interlayers of 0.06 in. soft "vinyl" and overall thickness of 0.295 in. has the best impact strength against flying fragments of the lenses tested. With the exception of a small area in the region of the nose rivets of the goggles this lens can withstand an impact from a 17 grain steel-cube fragment-simulating projectile at velocities up to 850 ft. per sec. at normal incidence without complete penetration. There is no flaking from the chosen goggles lenses up to about 600 ft. per sec. and up to 850 ft. per sec. all fragments alighting on the eye could be washed out of the eye or blown off.

High-pressure Metallurgy

Metals melted under very high pressures differ greatly from those melted under normal atmospheric pressure or even under vacuum. According to P. M. Unterweister, metallurgical editor of *Iron Age*, writing in that journal (January 30, 1958) the element of high pressure has the potential for producing astounding metallurgical results, many molten or liquid materials undergoing changes that can be carried over to the solid state. Such changes can be expected to result in altered physical and mechanical properties. Iron meteorites provide some insight into what may be expected of iron-nickel alloys formed under tremendous pressures. Research into the nature of these materials is sparse, but it is known that meteorites contain such alloys differing considerably from those produced by normal metallurgical processes.

The United States National Bureau of Standards has developed a technique for testing materials at ultra-high pressures up to 450,000 lb. per sq. in. It is interesting, although the apparatus and test specimens are of minute proportions. Indeed, it is proposed to conduct experiments in a needle-size bore drilled through a perfect 7½ carat diamond, the bore diameter being 0.015 in. drilled completely through the centre.

A test sample is located in the bore between two tiny, close-fitting pistons of hardened tool steel inserted, one from each end. To provide pressure and heat, the assembly is placed in a hydraulic press and is surrounded by an induction heating coil.

The fact that the pressure chamber is tiny has the advantage that by applying a weight of about 80 lb., it is possible to develop internal pressures up to about 450,000 lb. per sq. in. Higher pressures, it is estimated, would very likely split the diamond. This basic research into high-pressure phenomena is expected to benefit both the military services and industry. The first materials to be tested will be quartz and other substances containing silica. The combinations of extraordinary heat and pressure that can be achieved, it is stated, actually simulate conditions that attend an atomic explosion or the launching of a guided missile.

American Letter

Economics and Labour

The US is struggling to readjust its economy to the energetic demands of its people. A business recession which has exceeded 20 per cent. in some metal lines and as much as 40 per cent. in steel production has brought on evidence of distress in sensitive industrial areas. Political solutions are proposed such as, for example, a £1,000,000,000 increase in defence material spending and a proposed £500,000,000 reduction in income tax. These would add a £1,500,000,000 impulse to oppose the recession tide. No great immediate change is expected from these manoeuvres.

As reported in the February 27 issue of the JOURNAL, unemployment in the US predicted at 7½ per cent, has now been reported at 5,173,000, the highest for 16 years, appropriately 8 per cent. of the 65,000,000 potential labour force. This situation is adding to the political problem of adjusting the labour surplus to the existing production needs.

Technical Programmes

The 1958 Nuclear Congress, March 17-21, in Chicago contains a list of papers screened mostly from last year's papers on nuclear science. No foundry work is involved. The Foundry Educational Foundation programme held on March 12 and 13 in Cleveland, Ohio, reported on educational needs in a panel discussion. The American Welding Society's meetings in St. Louis April 15 to 17, at the Kiel Auditorium contain one session dealing with casting weldments.

Shipbuilding

The United States dropped from sixth to eighth place among 26 merchant shipbuilding nations last year, according to a report by the Shipbuilders Council of America. Great Britain continued to hold the lead, based on the gross tonnage of vessels under construction or on order. West Germany displaced Japan in second, with the Japanese third.

Of the world total of 34,494,214 gross tons reported as of January 1, a total of 1,080 tankers accounted for 22,666,054 tons, 1,607 cargo ships totalled 11,174,510 tons and 39 passenger and combination cargo-passenger ships amounted to 653,650 tons.

Scotland Exports More

From Scotland comes a report that there is a brighter side to the otherwise gloomy aspects of her industrial set-up. Scottish exports have made conspicuous progress in many markets—notably in North America—and Scottish industry is well qualified to supply the manufactures, mostly engineering products, in which the Canadian Trade Mission recently showed special interest.

Scotland's post-war expansion in industrial production seems to have been checked for the first time since 1952. In 1956 Scotland's progress continued although the rest of Britain recorded a levelling-off. Last year the rest of the country resumed its rise but Scotland continued at the same level as the preceding year.

Demand for labour eased although the general level of business activity was little changed compared with 1956 and skilled workers in most categories remained scarce. Throughout most of the year the total unemployed was greater than 12 months before and in many branches of industry overtime working was reduced and short-time was extended.

News in Brief

ROTHERHAM EDUCATION COMMITTEE is to make a grant of £15 towards the cost of a visit of students from Rotherham Technical College to Germany at Whitsuntide. The students will tour industrial plants in Germany.

COLONEL ARTHUR JERRETT, managing director of Guy Motors, Limited, of Wolverhampton, who recently returned from a business trip to Portugal, brought with him an order worth nearly £23,000 for ten of his company's bus chassis.

SINCE THE VISIT of Mr. J. C. Bamford, managing director of J. C. Bamford (Excavators), Limited, of Lakeside Works, Rocester, Staffs, to European countries many orders have resulted and the first machines have already been despatched.

THE BIRMINGHAM AREA SALES OFFICE of Northern Aluminium Company, Limited, on March 24, removed to new premises at Devonshire House, Great Charles Street, Birmingham, 3. It will be as before under the management of Mr. D. W. Taylor.

Mr. S. W. MARTIN, chairman of the Staveley Iron and Chemical Company, Limited, has selected 16 young employees of the firm to go on an 11-day continental coach tour. The party will leave on April 11, and will visit firms in Germany and France.

IT IS REPORTED that exports of iron ore from Sierra Leone in 1957 were a record, when a total of 1,487,000 tons was exported. Of this total, 737,000 tons went to Britain; 342,000 tons to Germany; 220,000 tons to Holland; 160,000 tons to the United States and 28,000 tons to Austria.

THE Metropolitan-Cammell Carriage & Wagon Company, Limited, Birmingham, has been awarded a contract, in face of strong competition, by Pakistan Government Railways. The contract, which is worth £1,500,000, is for the supply of 1,365 four-wheeled covered wagons.

ABOUT THIRTY STUDENTS from the National Foundry College, Wolverhampton, recently visited the Dudley Foundry Company, Limited. They were welcomed by Mr. H. C. Harrison, general manager and a director, and were conducted on a tour of the foundry by Mr. Tomlinson, Mr. Tilt and Mr. Crutch.

THE REGISTRAR OF RESTRICTIVE TRADING AGREEMENTS has been directed by the Board of Trade to give priority, in reference to the Restrictive Practices Court, to agreements relating to the supply of, *inter alia*, baths where the fixing of prices or minimum prices for different categories of consumers is to be considered.

J. SAGAR & COMPANY, LIMITED, woodworking machine manufacturers, of Halifax, is to close its works at Halifax and transfer production to the works of Wadkin, Limited, Leicester, with whom it merged two years ago. During the war the Halifax firm developed special machinery for the manufacture of aircraft propellers.

THE GENERAL ELECTRIC COMPANY, LIMITED, has received an order for £70,000 worth of traction equipment for three new four-coach trains and four additional trailer coaches, which are to be built in Portugal for the Estoril Railway. The new coaches will be built by Sociedades Reunidas de Fabricaçoes Metálicas Lda (Sorefame), of Amadora.

A CONTRACT worth £2,250,000 has been secured by the Wishaw (Lanarkshire) firm of R. Y. Pickering & Company, Limited, carriage and wagon builders. Dr. T. Scott Glover, managing director of the firm, said the contract, which is for 1,364 freight vans and 400 cattle wagons for the Pakistan Government Railways, will ensure work for the firm's 800 employees for the next 12 months.

BY USING MODERN BRITISH MACHINERY in a new flour mill which has just been erected in the Republic of Honduras, the manufacturers claim that they have been able to cut the cost of the flour to consumers and have also greatly improved its quality. The new all-pneumatic mill was equipped by Thomas Robinson & Son, Limited, of Rochdale, one of the foremost flour-milling machinery manufacturers in the world, for Molino Harinero Sula S.A.

AT THE FORTHCOMING MILAN FAIR, April 12 to 25, A. Triulzi, S.A.S., principals of Alexander Cardew, Limited, Knightsbridge, London, S.W.1, will be exhibiting their die-casting and plastic machines, also the latest developments in their production programme. The die-casting machine stand (Nos. 17455/57/59/61) will be located in the Palazza della Meccanica, No. 17, and the plastic machine stand (Nos. 26030/32) in the Salone Materie Plastiche, No. 26.

A. V. ROE CANADA, LIMITED, which is controlled by Dominion Steel & Coal Corporation, Limited, states that operations will continue at around 68 to 72 per cent. of capacity at its Sydney (Nova Scotia) steel mill until at least August. The Corporation also reports that 4,300 men are being employed at the basic steel plant, which has an annual capacity of 1,000,000 ingot tons. The Corporation maintains a higher operating ratio than that of the US steel industry.

A GIFT OF £500 has been made by Baker Perkins, Limited, engineers, Peterborough, to the commerce department of the Peterborough Technical College. Previously the company gave £3,500 to be used in connection with a technical laboratory at the new college premises at Eastfield. The commerce department will shortly be transferred to Eastfield from the old New Road premises and it is probable that the £500 will be used to provide equipment.

ABOUT 160 SHEFFIELD WORKS started a "Better Housekeeping Week" on Monday, March 24, in an organized campaign to tidy up the works and help in the prevention of accidents. The scheme has been sponsored by the Sheffield area industrial group of the Royal Society for the Prevention of Accidents, and started in Sheffield in 1949. In those days of steel-scrap shortage one firm produced 350 tons of scrap from cleaning up, and another 200 tons.

MORE THAN 2,000 EMPLOYEES of Thomas Firth and John Brown & Company, Limited, and Firth-Derihon Stampings, Limited, recently attended a private film show at the City Hall, Sheffield, when the programme included two films—"A Tour of the Firth-Brown Works," and "The Farnborough Air Show 1957," —which had been taken by the company's own film unit. The film of the works is being presented to Sheffield Corporation for the historical archives.

FOLLOWING THE ANNUAL GENERAL MEETING of the Non-Ferrous Club, which was held on March 19 in Birmingham, the committee has been re-formed to organize the club's affairs for the ensuing year. The new officers are as follows:—president, Mr. W. H. Demel (Harrisons (Birmingham), Limited); chairman, Mr. H. McGhee (Nicholson & Rhodes, Limited); secretary, Mr. W. H. Vizor (Deutsch & Brenner, Limited), and treasurer, Mr. T. B. Taylor (E. A. Chalmers & Company, Limited).

SIR JOHN HUNT, leader of the British expedition to Mount Everest in 1952 to 1953, was the chairman of

the week-end residential conference which the United Steel Companies, Limited, held for 110 apprentices and junior operatives at Cambridge from March 28 to 31. It is the fourth successive year the conference has been held and again the theme was "responsibility." During their stay at Downing College, the junior employees heard talks given by industrial and educational authorities and took part in discussion groups.

THE CLOSURE on March 29 of the foundry of the Steel Nut and Joseph Hampton Company, Limited, Wednesbury, made redundant some 100 employees for whom alternative work has been found and a further 30 to 40 unskilled operators whom it is hoped to be able to place in alternative work. Mr. B. A. Garman, joint managing director, said that the foundry was being closed because it was no longer economic for the company to make its own castings. Recently there had been more specialization in the foundry industry and it was cheaper to buy from specialist founders.

AT THE MARCH MEETING in Birmingham of the National Union of Manufacturers, a decision was taken to press for Government action to extend credit for smaller firms. Some modification of the credit squeeze was considered necessary to alleviate the position of smaller manufacturers, many of whom were seriously handicapped by having to wait for payment from larger firms. It was also reported at the meeting that several parties of members would be attending the Brussels Universal Exhibition on two-day and three-day visits; the committee is considering arranging one-day trips by air for industrial workers which would cost about £15 per person.

ZIRCONAL, LIMITED, Clyde Vale, Dartmouth Road, Forest Hill, S.E.23, announce the conclusion of an agreement between it and the Société pour la Construction d'Appareils Thermiques, 29, Rue de Mogador, Paris 9e. Under the agreement, SCAT are establishing a factory for the production of zirconal-type special refractories and both companies have agreed to exchange technical information. Zirconal, Limited also receives under the agreement all design "know-how" for the SCAT types of high-temperature furnaces for many applications, and in particular will be undertaking the production of the high-temperature radiant bricks developed by SCAT.

THE EIGHTH SYMPOSIUM organized by the Aluminium Development Association, 33, Grosvenor Street, London, W.1, will be held at the Savoy Hotel, London, on June 12. The subject will be "Aluminium in Packaging" and discussion will be divided between two sessions: in the morning, on "Aluminium as a Packaging Material"; in the afternoon, on "The Uses of Aluminium in particular Aspects of Packaging." The field to be covered is both varied and wide, with interest concentrated on non-returnable containers. Within this scope, eight papers, which will be sent in preprint form to those accepting invitations to attend, will be submitted for discussion.

REPLIES TO A QUESTIONNAIRE sent out by the Institution of Chemical Engineers, have been received from professors, technical college principals and heads of departments in Great Britain regarding the present and future supply of chemical engineers and the difficulties experienced in obtaining suitable teaching staff. From these replies it is estimated that by 1966, with adequate support, the country could provide 950 chemical engineers a year, as compared with just under 300 in 1956. This is better than the minimum goal for scientists and engineers as a whole given in "Scientific and Engineering Manpower in Great Britain" (HMSO, 1956) but falls short of the estimates of some leading chemical engineers.

Mr. W. E. BALLARD, president of the Dudley Chamber of Commerce, suggested at the annual meeting of the Chamber that Dudley should have its own representative permanently travelling Europe to advertise the industries of the town. He also suggested that the secretariat in Dudley no longer fulfilled the need for expert advice from the Chamber which manufacturers required, and he urged that the Chambers of Birmingham, Dudley, Walsall and Wolverhampton should combine to provide a secretariat. He said it could be done without any Chamber losing its autonomy and manufacturers would be able immediately to get precise information on complex problems. A third suggestion made by Mr. Ballard was that the Chamber should collect authentic examples of wastage of manpower or money within the nationalized industries.

THE PROFESSIONAL ENGINEERS APPOINTMENTS BUREAU, in its report for 1957, states that a steady demand for engineers of all grades was maintained during the year, although some reduction in the numbers of vacancies notified became apparent during the latter months. Enrolments of engineers with the Bureau showed no obvious fluctuations and were similar to 1956, although not as high as the two previous years, when approximately 2,000 enrolments were recorded. The numbers of engineers submitted to the notified vacancies were similar to last year but less than in 1955. The number on the register has been comparatively constant throughout the year, enabling fair selections to be made for the majority of vacancies notified. There was a continued increase in those over 50 years of age who enrolled without any comparable increase in vacancies where employers were prepared to consider this age group. In conclusion, the Bureau draws attention to a recent change of address to 39, Victoria Street, London, S.W.1.

Dinner

ALAR, LIMITED

ALAR—The Association of Light Alloy Refiners—held their ladies' evening at the Trocadero last week. Mr. F. Farenden presided and the speakers were Dr. E. G. West, Mr. M. G. Gittins and Mr. E. J. Groom. Amongst those present were Mr. V. P. Harries, C.B., Mr. L. J. Chandler, Mr. L. J. Fletcher, Mr. A. P. Fenn, Mr. W. D. Mendham, Mr. Miles C. Elton, Mr. V. C. Faulkner, and Mr. L. G. Beresford, all of whom were accompanied by their ladies. Dancing to Eddie Strevens and his band was interspersed with a cabaret consisting of Sonny Binick and Sally Brock (ballroom dancing) and Michael Bailey (modern magic).

Sporting Calendar. Eyre Smelting Company, Limited, Tandem Works, Merton Abbey, London, S.W.19, have used a series of sporting pictures for the bi-monthly sheets of their works' calendar, which—curiously—begins with April and May (illustrated by the Boat Race) and ends with February and March, 1959 (soccer-match picture). Then, on pink sheets at the end are recorded British and international sporting achievements for the period 1949-1957 and a calendar of events for April to December, 1958. The whole makes a pleasing and useful compendium.

Current Prices of Iron, Steel, and Non-ferrous Metals

(*Delivered unless otherwise stated*)

April 1, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered*)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £47 10s. 0d. to £48 0s. 0d., scale 17s. 0d. per unit; 75 per cent. Si, £67 0s 0d. to £67 10s. 0d., scale 17s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 8s. 4d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 11s. 4d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £91 10s. 0d., basis 60 per cent. Cr, scale 30s. 0d. to 30s. 6d., per unit; over 6 per cent. C, £87 10s. 0d., basis 60 per cent. Cr, scale 30s. 6d. per unit; 2 per cent. C,* 2s. 1d. to 1½d. per lb. Cr; 1 per cent. C,* 2s. 1½d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 3½d. to 7s. 10½d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £282 0s. 0d.; 96/98 per cent., £315 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 20s. 9d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £83 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., £32 15s. 6d.; tested, 0.08 to 0.33 per cent. C, £33 15s., 6d.; hard (0.41 to 0.60 per cent. C), £34 17s. 0d.; silico-manganese, £43 16s. 6d.; free-cutting, £36 14s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E. Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over, £40 0s. 6d. (under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.); hoop and strip, coils, £39 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £44 16s. 0d.; black sheets (hand mill), 24g., £58 14s. 6d.; galvanized corrugated sheets, 24g., £66 16s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 11s. 0d.; nickel-chrome-molybdenum, £111 19s. 0d.

NON-FERROUS METALS

Copper.—Cash, £179 5s. 0d. to £179 10s. 0d.; three months, £179 15s. 0d. to £180 0s. 0d.; settlement, £179 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 8¾d. per lb.; rods, 204s. 0d. per cwt. basis; 20 s.w.g., 237s. 3d. per cwt.

Tin.—Cash, £730 0s. 0d. to £730 10s. 0d.; three months, £724 10s. 0d. to £725 0s. 0d.; settlement, £730 10s. 0d.

Lead (Refined Pig).—First half April, £73 17s. 6d. to £74 0s. 0d.; first half July, £73 17s. 6d. to £74 0s. 0d.

Zinc.—First half April, £63 5s. 0d. to £63 7s. 6d.; first half July, £63 0s. 0d. to £63 5s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £97 5s. 0d.; rolled zinc (boiler plates), all English destinations, £95 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £85 10s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 5d. per lb.; sheets to 10 w.g., 153s. 3d. per cwt.; wire, 2s. 3½d.; rolled metal, 153s. 3d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £130; B6 (85/15), — ; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £167; HTB2 (38 tons), £182; HTB3 (48 tons), £189.

Gunmetal.—BS1400, LG2 (85/5/5/5), £155; LG3 (86/7/5/2), £167; G1 (88/10/2/½), £224; (88/10/2/1), £217.

Phosphor Bronze.—BS1400, PB1 (AID released), £240 per ton.

Phosphor Bronze Strip, etc.—Strip, 230s. 9d. per cwt.; wire, 3s. 5½d. per lb.; rods, 2s. 9½d.; tubes, 2s. 9½d.; chill cast bars: solids 2s. 10½d.; cored 2s. 11½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 4½d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 9d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 8d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £77 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, £200; AB2, — .

* Average 68-70 per cent.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

MIDDLESEX, May 2—Construction, mostly in trench, of about 1,330 lin. yd. of 14-in. dia. cast-iron rising main and associated works. Documents from J. D. & D. M. Watson, 18, Queen Anne's Gate, London, S.W.1. Deposit £5 5s. 0d.

COALVILLE, LEICS, April 12—Supply and delivery to sites of 760 lin. yd. 4-in. dia. class B spun-iron pipes with flexible joints, in 4 yd. or 6 yd. lengths, to comply with BSS 1211, for the Urban District Council. Tenders marked "Water Supply Pipes, etc.," to H. B. Chynoweth, Clerk of the Council, Municipal Offices, Coalville.

BELFAST, April 17—Supply of the following for City Council: (*a*) brass and copper fittings, etc.; casks, drums, etc., cast-iron pipes and fittings, compo pipe; and iron castings. Documents from Gasworks, Ormeau Road, Belfast.

LARNE, ANTRIM, April 9—Following for Rural District Council: Drains Bay sewerage scheme—supplying and laying approximately 243 lin. yd. 15-in. and 6-in. cast-iron pipe together with manholes and other ancillary works, including pumping station. Documents from the Rural Council Offices, Larne.

SOUTH AFRICA—Mr. Hugh H. Jones, proprietor of Jones Engineering Company of 10, End Street, P.O. Box 4783, Johannesburg, is interested in representing United Kingdom firms for: (1) A range of air-operated foundry vibrators; (2) electric vibrators, and (3) foundry shake outs. Manufacturers interested in this agency inquiry should write direct to Mr. Jones. It would be appreciated if, at the same time, they would notify the United Kingdom Trade Commissioner, Pritchard House, Pritchard Street (cor. Von Weilligh Street), P.O. Box 10101, Johannesburg, that they have done so. (ESB/7374/58.)

SOUTH AFRICA, April 23—Air compressors, oil-flooded rotary type. (ESB/7816/58.)

Forthcoming Events

APRIL 7

Incorporated Plant Engineers

Dundee branch: "Uses of Electronics," by R. B. Smith, 7.30 p.m., at Mathers Hotel.

APRIL 10

Institute of British Foundrymen

Beds/Herts section: Annual general meeting followed by paper of topical interest, 7.30 p.m., at K. & L. Steelfounders and Engineers, Limited, Letchworth.

Leeds Metallurgical Society

"Pressure-die-casting," by G. Kelly, at West Yorkshire Foundries, Limited, Leeds.

Incorporated Plant Engineers

North East branch: "Some Aspects of Lubrication," by W. P. F. Jolly, 7 p.m., at Roadway House, Oxford Street, Newcastle-upon-Tyne.

Combustion Engineering Association

Southern region: "Measurement of Oxygen in Flue Gases," by F. T. Ashmore, and "Measurement of Oxygen in Feed Water," 10 a.m., at the St. Ermin's Hotel, London, S.W.1.

Institute of British Foundrymen

APRIL 11

Tees-side branch: Annual general meeting followed by presentation of Apprentice Competition awards, and reading of the prize-winning entry in the Short Paper Competition. The meeting will be held in the Teesdale Hall of Head Wrightson & Company, Limited, Thornaby.

APRIL 12

Bristol & West of England branch: "Modern Developments in Cupola Practice," by W. Y. Buchanan, 2.45 p.m., at Stroud. (Details from the secretary.)

West Riding of Yorkshire branch: Annual general meeting and election of officers, 6.30 p.m., at the Bradford Institute of Technology.

Newcastle and district branch: Annual general meeting and "Training of Foundry Apprentices," by D. Worth, 6 p.m., in the Neville Hall, Westgate Road.

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Personal

Mr. F. RODRIGUEZ, M.I.B.F., has been appointed works manager to Alite Foundry, Limited, Holloway, London, N.7.

MAHARAJA SIR PRATAP CHANDRA BHANJ DEO has been appointed a director of the Indian Iron and Steel Company in place of the late Mr. K. L. JATIA.

Mr. H. B. HARRIS, a production engineer with F. Perkins, Limited, Peterborough, has been elected chairman of the Peterborough section of the Institution of Production Engineers.

Mr. J. P. ELLIS, hon. lanternist for many years of the London branch of the Institute of British Foundrymen, has changed his private address to Blossom Cottage, Mead Road, Edenbridge, Kent.

Mr. N. R. D. GURNEY, formerly chief engineer, electrical general engineering department, Metropolitan-Vickers Electrical Company, Limited, has been appointed sales manager, plant department. Mr. Gurney succeeds Mr. R. J. Cochran who is seconded to special duties.

Mr. DENIS S. PLAYER has been elected deputy chairman of the Newall Engineering Company, Limited, and its subsidiaries—Optical Measuring Tools, Limited, Keighley Grinders (Machine Tools), Limited, James C. Kay & Company, Limited, and the Newall Machine Tool Corporation of Canada.

Mr. GEORGE BOEX retires by rotation from the board of the British Aluminium Company, Limited, on May 6. Owing to advancing years he does not wish to seek re-election, but will continue in a consultative capacity. Mr. Boex is a former managing director of British Aluminium and associated companies.

Mr. GEORGE WRIGHT, London manager of the Incandescent Group of furnace engineers, Smethwick, left on March 31 for an extended market investigation in India. The Group has had a long association with India, and Mr. Wright will report on the new openings for capital goods in this rapidly expanding market.

Mr. W. K. G. ALLEN, chairman and joint managing director of W. H. Allen, Sons & Company, Limited, hydraulic and electrical engineers, etc., of Bedford, and a director of Whessoe, Limited, oil refinery equipment, etc., manufacturers, of Darlington, has been appointed High Sheriff of Bedfordshire for the coming year. Mr. Allen's grandfather, uncle, and father have occupied the office previously.

Mr. S. W. HAYNES, secretary of Charles W. Taylor & Son, Limited, ironfounders and propeller manufacturers, of South Shields, has received presentations to mark his completion of over 50 years' service with the company. Mr. Haynes, who is 64, started at William Black's foundry in South Shields in 1908, and in 1909 that firm was taken over by Charles W. Taylor & Son. He became secretary of the company in 1951.

SIR WILLIAM WALLACE, chairman of Brown Bros. & Company, Limited, Rosebank Ironworks, Edinburgh, was presented with a set of fitted dressing cases by the directors of the firm at a dinner in his honour on March 20. The dinner and presentation marked the termination of his managing directorship, from which he retired on December 31 after 40 years' service in that capacity. The presentation was made by Mr. Andrew Betts Brown, a director of the company and grandson of the founder.

Mr. J. T. MCLEOD, who recently retired from the managing directorship of Widdop & Company, Limited, diesel-engine makers, of Keighley, had a pleasant surprise on Wednesday evening (March 19). He was called for at his home and taken by car to a local hotel, where a social evening was in full swing—an event organized to support the presentation to him of an armchair from the employees of the firm. Seventy-year old JACK WALTON, who had been with the firm for 40 years, made the presentation and the 120 present were joined in the games and dancing by Mr. and Mrs. McLeod. Two Nigerian students arrived in full native dress to add more colour to the proceedings. A bouquet was handed to Mrs. McLeod by Miss J. HAIGH, secretary to Mr. McLeod's successor, Mr. A. A. SCAIFE, who acted as chairman for the evening.

Obituary

Mr. A. W. GRANT, who for many years until his retirement was traffic manager at the Thorncliffe Works, near Sheffield, of Newton, Chambers & Company, Limited, died on March 25 at the age of 77.

From Australia the death is announced of Mr. C. G. HILL, who with Major Rhyddach (as he was known in Sheffield in the years just after the 1914 war) founded the Institute of Australian Foundrymen in 1943. Mr. Hill was one of the 200 Australians who took part in the fighting which followed the Russian Revolution after world war I, and around Archangel lost a leg. Throughout his life he did much work for the various ex-servicemen's associations.

Contraction in Machine-Tool Industry

Fall in value by a further £1,900,000 in December to £78,700,000 (the lowest level since October, 1954, when both production capacity and prices were lower than at present) is reported for the order-book of the machine-tool industry. It now represents about nine months' output at last year's best rates, but there are signs that production is being affected by the fall-off in orders. With production £10,000,000 higher at £95,000,000 last year, orders declined by £8,000,000 compared with 1956.

New orders from home customers in December were the highest since July at £5,050,000, but oversea orders continued to run well below 1956 levels. Estimates that spending on plant and machinery by manufacturing industry will be substantially unchanged in 1958 are supported by the total of home orders for the second half of 1957, which showed very little change over the corresponding period in 1956. Orders from the motor industry have begun to improve, but these are partly offset by a further decline in orders for standard tools mainly used in general engineering.

Delivery dates have generally been sharply reduced—in some cases to a third of the periods quoted 12 months ago. Demand for some types of plant, especially the specialized heavy machines, remains comparatively high, but as demand falls off abroad, the UK export market for machine tools is less buoyant.

Last year exports rose to a new peak of £28,000,000, but outstanding export orders declined by £3,700,000 over the year—a drop of 16 per cent.—and in February oversea shipments fell markedly below 1957 levels. Imports, however, have been considerably affected by the drop in UK demand, and after falling sharply last year were worth 18 per cent. less in January-February than in the first two months of 1957.

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F5/29

Company News

ENFIELD CABLES, LIMITED—Following the recovery experienced in 1957, the company is resuming dividends on the £1,400,000 ordinary with a payment of 2½ per cent. The previous distribution was 5 per cent. for 1952. Group surplus improved to £162,885 (£103,051), although losses on fluctuations in metal prices reduced the profit by £130,000 (£85,000).

ANTI-ATTRITION METAL COMPANY, LIMITED—The continued fall in the price of copper with its effect on stock values, and lower profit margins, have reduced profits to £28,930 (£82,108) before tax of £11,875 (£39,250). A dividend of 4 per cent. is being paid for the year to July 31, 1957, compared with 7½ per cent. and the centenary bonus of 1 per cent. in 1956.

WILLENHALL MOTOR RADIATOR COMPANY, LIMITED—A final dividend of 22½ per cent. makes 30 per cent. for 1957 on capital increased from £100,000 to £175,000 by a three-for-four scrip issue. This compares with the equivalent of 25⅝ per cent. for 1956. The trading profit, etc., of £214,860 goes against £217,750, and the net profit of £76,962 compares with £83,130, after tax of £93,311 (£90,814).

GEO. ANGUS & COMPANY, LIMITED, power transmission and fluid sealing, etc., engineers, of Newcastle-upon-Tyne—The company is cutting its final ordinary dividend from 7½ per cent. to 6 per cent., making, with the lower 4 per cent. (5 per cent.) interim, a total of 10 per cent. for 1957, against 12½ per cent. Tax, other than profits tax on dividends, takes £114,000 (£208,000), leaving the profit down from £343,000 to £147,000. The figures are subject to audit.

SUN CYCLE & FITTINGS COMPANY, LIMITED—Mr. F. C. Parkes, chairman, states that Tube Investments, Limited, as an alternative to its offer of one TI ordinary £1 share for every 10½ shares, now offers ordinary holders the option of taking a cash payment of 5s. 4½d. per 4s. share. The Franco-British & General Trust, which had already offered to purchase both classes of the company's shares at par, has stated that as the TI offer makes it virtually impossible to the Trust to receive acceptances in respect of 90 per cent. of each class, holders who have already accepted its offer may, if they wish, withdraw their acceptances.

BRITISH ALUMINIUM COMPANY, LIMITED—The company is maintaining its final dividend at 8 per cent. on capital increased from £7,000,000 to £9,000,000 by a rights issue. The interim on the old capital was held at 4 per cent. Consolidated manufacturing and trading profits, less losses and after depreciation, amounted to £3,020,706 for 1957, compared with £3,294,439. Depreciation provided was £810,165 (£858,302), and £200,000 (£250,000) was transferred to plant replacements reserve. After interest and tax charges, the profit balance is £1,247,389 (£1,330,989). There is added a credit for unrequired tax provisions of £651,720 (£253,280).

DESOUTTER BROS. (HOLDINGS), LIMITED, pneumatic and electrical portable-tool manufacturers, of London, N.W.10—A final dividend of 12½ per cent. on the doubled capital makes the equivalent to 18¾ per cent. on the present £700,000 combined ordinary for 1957, representing a 2½ per cent. increase over 1956. Group profits rose from £550,570 to £574,556. After tax of £301,392 (£281,516), the group net profit of £273,164 compares with £269,054. Deducting outside interests of £1,933 (£14,268 written off buildings) there is £271,231 against £254,786, attributable to the parent company. The group profit includes approximately three months trading of Lang Pneumatic, Limited, Wolverhampton, which was acquired last October.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

787,540. Pettibone Mulliken Corporation, 2424 North Cicero Avenue, Chicago, 39, Illinois, USA.

Moulding machines. The invention is particularly concerned with means for clamping a flask in the moulding machine and the subsequent removal of the flask from the machine. Objectives of the patent are to provide hydraulic means independent of clamping, for positioning the head of the moulding machine to enable it to operate efficiently with flasks of various heights; to equalize the pressure on the clamping shoes which clamp the flask in the machine, and to facilitate the sliding of the flask laterally on to a conveyor by employing take-off rollers.

787,616. J. S. Hoekstra, Van 't Haaffstraat 30, Noordwijkerhout, Holland, and H. J M. Verschure, Cliostraat 46, Amsterdam, Holland.

Processes for the manufacture of shell moulds for complicated castings. The shell material introduced into the mould cavity, corresponding to the casting to be made or to part thereof, is subjected to centrifugal action before the material has set (hardened).

787,636/7. Wm. Jessop and Sons, Limited, Brightside Works, Sheffield.

Improvements in nickel/chromium austenitic alloys and other alloys by the addition of cerium.

787,658. Imperial Chemical Industries, Limited, Imperial Chemical House, Millbank, London, S.W.1.

Improvements in continuous casting of metals and alloys for the production of comparatively restricted lengths of casting. It is of particular use in the casting of aluminium-base alloys and of copper-base alloys.

787,665. J. Stone and Company (Charlton), Limited, Woolwich Road, Charlton, London, S.E.7.

An aluminium-base alloy comprising in the alloy as cast: 0.2 to 5 per cent. of lithium and containing not more than 0.008 per cent. of sodium.

787,793. Fritz Hansberg, 13 Via Archirola, Modena, Italy.

A clamping device which serves to clamp a corebox or mould box to a moulding-machine table and to press together the several parts of the box which is provided with separate joints, during the abrupt filling operation.

789,858. General Motors Corporation, Grand Boulevard, Detroit, Michigan, USA.

This patent relates to the manufacture of cylinder heads for internal combustion engines, and in particular to a core assembly for use in casting a cylinder head for an overhead valve engine. (See also Patent No. 762,741, FOUNDRY TRADE JOURNAL, January 24, 1957.)

789,892. Mannesmann AG., Mannesmannufer Ib., Düsseldorf, Germany.

The manufacture of steel or technically pure iron from all kinds of pig-iron, especially Thomas pig-iron.

789,916. United States Pipe and Foundry Company, 3,300, First Avenue, City of Birmingham, Zone 2, Alabama, USA.

Improvements in a method for making tubular-metal castings in a horizontal, cylindrical metal mould.

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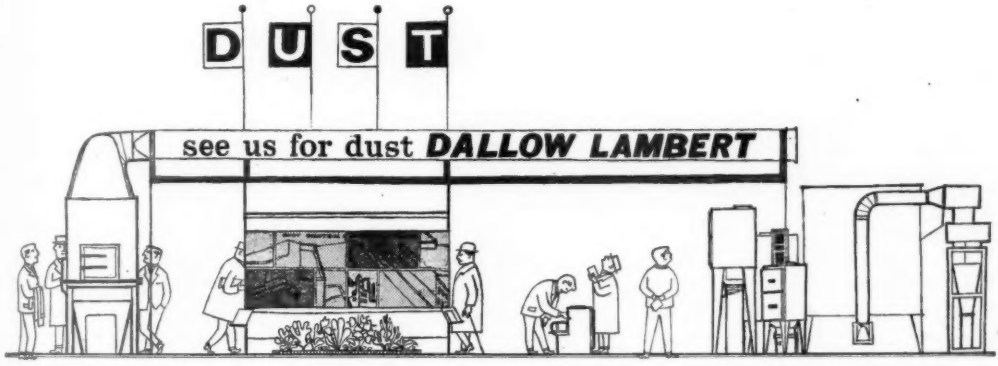

Stand D32 at the Factory Equipment Exhibition, Earls Court, April 14–19

If you have a factory dust problem, we'd like to show you a likely answer to it. At the Factory Equipment Exhibition you can see what is probably the most comprehensive display of dust control equipment ever to be shown. One of these units —the Wet Deduster, the Drytube Filter, the high efficiency Cyclone, the Dustmaster (which is actually 120 units in one!), or the compact little Drytex —is almost certainly the way out for your dust. See us for dust and we'll show you which one.

DALLOW LAMBERT

DALLOW LAMBERT & CO., LTD., THURMASTON, LEICESTER.

CRC 70

Raw Material Markets

Iron and Steel

Pig-iron consumers do not benefit from the price concessions made on Monday. They were made possible by the lower prices of imported materials, iron ore especially, and presumably foundry iron is left out because it is made mainly from native ore.

Nearly all steel products (stainless steel is an exception) are reduced in price, and although individual reductions are not large, ranging between 1 per cent. and 3 per cent., they together should save home consumers some £10,000,000 a year.

Examples of basis price reductions are:—Light sections and bars, wire rods, 7s. 6d. a ton; plates and heavy sections, 10s.; strip-mill sheets, 20s.; cold-rolled strip, 35s. Strip-mill tinplate is reduced by 6d. a basis box, but reductions in extras, particularly in the lighter gauges, provide an overall reduction equivalent to 1s. 1½d. a basis box (or to about 27s. 6d. a ton).

Pig-iron production continues to be maintained at an average annual rate of over 14,000,000 tons from the 98 furnaces now in blast. Although outputs are not at capacity levels, they are adequate for consumers' current needs, and for some grades are in excess of demands. Basic steelmaking pig-iron, the major portion of outputs, is sufficient for current consumption and stock requirements and, should the need arise, increased tonnages could be made available.

Foundry pig-irons and hematite are also in good supply and consumers have little difficulty in obtaining the pig-irons of their choice. The chief demand continues to come from the engineering and speciality foundries for the low-phosphorus irons and the supply position at present is more satisfactory than it has been for some time past.

The motor vehicle trades are the main users of high-duty castings and they are keeping the foundries catering for them well employed. The call for high-duty castings from many trades has been upheld satisfactorily for some time, but there is some slackening off from the heavy engineering trades. Demands from machine-tool makers have recently shown a marked decline which is causing short-time working at some of the foundries.

The scarcity of work at most of the light and textile foundries as well as at some of the jobbing foundries, continues to be reflected in the moderate demands for high-phosphorus irons. Seasonal demands coupled with possibly some relaxation in the present economic restrictions may bring an improvement in business from the domestic utensile and the building trades for light castings, but this cannot be foreseen at present. High-phosphorus pig-iron remains very plentiful, and makers of this grade as well as of hematite and refined irons are able to undertake overseas orders—when these can be secured against prevailing strong competition.

The foundries are able to cover for their requirements of scrap, the chief call being for the heavy cast-iron and machinery scrap. Supplies of medium and light scrap are plentiful, foundry coke deliveries are satisfactory, and ganister, limestone, and firebricks are adequate.

The decline in activity at many of the re-rolling mills continues, particularly at the light mills, where orders are scarce for small bars and light sections. Most of the heavier mills are employed on a better scale, but for these sizes also the recent reduced demand continues, as well as for some sizes of reinforcing rods. For many products of the re-rollers difficulty is experienced from day to day in making up the rolling programme.

Home supplies of semi-finished steel are more than sufficient to keep the re-rollers adequately supplied. Many of them are still working on stocks which are being reduced to a minimum and current buying is strictly confined to supplies for immediate consumption requirements. The demand for slightly defective material and crops is negligible, current prices being far too high to prove attractive.

CURRENT PRICES OF IRON AND STEEL
The weekly list of prices of iron, steel, and non-ferrous metals will be found on p. 404.

Non-ferrous Metals

Factors contributing to a firmer appearance in copper towards the end of last week were the labour situation at Chuquicamata and a tendency on the part of sellers to hold back pending developments in the United States market. Consumer demand has been uneventful, although rather more interest has been noted from France of late.

Quietness in America and easier Singapore advices have given a subdued tone to the London tin market. Fresh trade on both sides of the Atlantic has been largely routine in character.

Lead consumption on this side of the Atlantic is keeping up satisfactorily, but trading interest has been at rather a low ebb. The demand for marginal supplies outside of those already contracted for is said to be virtually non-existent. There is little new to report in zinc, in which business has continued along routine lines.

1958 I.E.A. Exhibition

The 1958 Instruments, Electronics and Automation Exhibition which is to be held at Olympia from April 16 to 25 will be on a larger scale than in previous years and is to include an international section for overseas exhibitors. This year another trade association has joined the five associations originally responsible for the exhibition, and additional floor space has been provided.

The Electrical Development Association will stage a display with the theme "Electronic Control—a Step towards Automation" on stand 301. A number of methods of electronic control will be demonstrated and visitors will be able to see the way in which these can be applied to individual industries. To this end a small-scale automatic production plant has been constructed and will be seen working during the exhibition.

Among the other exhibits and demonstrations will be punched-card weighing machines for the weighing of different ingredients required in mixing materials, and a photo-copying system for use in the factory.

House Organ

Sif-Tips, Vol. 23, No. 100; issued by Suffolk Iron Foundry (1920) Limited, Stowmarket, Suffolk.

This issue contains articles on the repair of a lorry radiator grille; an exhaust manifold; a carburettor; gear-wheel teeth; a 250-gallon-capacity steel boiler; and a tractor axle-casing. On the manufacturing side, there is an account of the manufacture of tubular-steel structures.

J. A. PRESTWICH INDUSTRIES, LIMITED—Mr. P. G. Langford has been appointed chairman in place of Mr. J. E. V. Jobson, who has resigned from the board owing to other commitments.